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SYCAMORE FIGS

Since the dawn of history, the sycamore fig has played a prominent part in the life of the people of Egypt and a few other oriental regions. The fact that it yields fruit throughout the entire year, perhaps, contributes to the esteem in which it is held; for to a westerner its fruit seems of little value, being small and without a particularly pleasing flavor, and only partly edible. Each fruit is entered by a small wasp, which lays eggs in it; the Egyptians, therefore, make holes in the ends of the fruits while they are still small, to admit air and keep the eggs from hatching. The variety here illustrated is that known as Roumi, which is the favorite at Cairo. (Frontispiece.)

THE SYCAMORE FIG IN EGYPT

Historic Tree is Widely Grown, and Furnishes Large Quantity of Inferior Fruit—Interesting Practices of the Natives—Life History of the Fig-Wasp

THOMAS W. BROWN AND F. G. WALSINGHAM
Cairo, Egypt

PERHAPS no tree in the world has to the same extent as the sycamore occupied the pens of writers from the dawn of history to the present time. It was one of the sacred trees of Arabia and Ancient Egypt, and in olden times played an important part in the cult of the dead. The sycamore was also the tree of Hathor, the goddess of love and marriage, on which account the lovers of Ancient Egypt were wont to tarry fondly under its branches in the hope of receiving the goddess' blessings. Even today, a vestige of this belief can be seen in the custom of women visiting the sycamore when troubled with matrimonial cares.

The sycamore is frequently mentioned in the Scriptures. The story of Zaccheus climbing a sycamore tree is, of course, familiar.

Amos was probably a gatherer of sycamore fruit. Muschler, in his Manual Flora of Egypt, describes the instrument used at the present time to cut the fruit open in order to ripen it, and in this connection he states that the process as described by Pliny closely corresponds with the modern method and, further, that "it would seem to be pretty certain that Amos performed identically the same operation on the figs as is still done in Egypt at this day."

The word "sycamore" which is derived from the two Greek words "Sucon" (fig), and "moro" (mulberry), is an appropriate name for this tree, because the leaves are not unlike those of a mulberry and the fruit closely resembles that of a common fig. The tree is also known as Pharaoh's fig.

The sycamore is found throughout Egypt—in the Delta, Nile Valley, and also in the Oases. It is a large evergreen tree with a round symmetrical head when young. The trunk is usually short, and as the tree increases in age the branches spread out more or less horizontally to a radius of 15 to 20 meters. The leaves are ovate, alternate and almost glabrous on both surfaces; petiole about half the length of the blade, furry pubescent; shoot pubescent, furnished with a ring of stipular hairs at the insertion of each leaf. The bark retains its herbaceous character for several years, eventually becoming grayish-brown in color, but without any fissures.

The fruit is borne almost entirely on specialized leafless branches, which arise on the ordinary vegetative branches. Rarely, a few figs are borne on the leaf-bearing shoots. The fruiting shoots generally appear first at points on the vegetative branches where the latter have a diameter of about 6 cm., although occasionally they are found on smaller branches. The internodes of the fruiting shoots are almost wholly suppressed so that growth in length is very slow. Secondary shoots are given off in a racemose manner at irregular intervals until a dense, much-divided fruiting branch is formed. These branches attain a length of about 30 cm. They persist for many years and may be found on the mother branches when the latter have attained a diameter of 30 to 40 cm.

FLOWERS ARE PECULIAR

Flowers of the fig trees commence bearing at the age of 5 to 6 years. The figs arise singly or in pairs in the axils of the fugacious scale-leaves of the fruit-bearing shoots. They attain a

YOUNG SYCAMORE FIG TREE

Once a year, and always on the same day, the Egyptians make a ring of bruises and scars in the bark of the trunks of their sycamore fig trees, under the belief that this makes them bear better. This custom, like many others in primitive agriculture, is doubtless a combination of pure superstition and empirical science. The idea that the trunk must be injured only on a certain saint's day appears to be superstitious; but the idea that it bears better with such treatment is borne out to some extent by modern experimental horticulture. It has frequently been found that ringing or girdling the trunk of a fruit tree will improve its yield. This may be due, in part at least, to the fact that starch and sugar, manufactured in the leaves, are prevented from descending in the soft inner bark and, being kept in the branches of the tree, form a stimulus to the production and maturation of fruit. The variety here shown is that known as Roumi at Cairo. (Fig. 1.)

maximum diameter of 65 mm. and a length of 45 mm. The figs of the autumn crops are somewhat smaller than those of the summer crops. The inner surface of the fig is occupied entirely with female flowers, with the exception of a group of staminate flowers which encircle the "eye." The female flower consists of a rudimentary perianth enclosing the ovary, and the latter is surmounted by a comparatively long style which is curved at the apex as shown in the drawing. It is usually supposed that the male flowers in these figs are all aborted. This, however, is not invariably true, as, especially in the late summer months, many of the figs have male flowers with well-developed stamens.

There are, as far as we know, two varieties of sycamore in Egypt. The most important of these is that known as "Roumi," Turki or Falaki. As compared with "Kelabi," by which name the second variety is known at Cairo, the branches of the old trees of the Roumi spread out more horizontally, the shoots are stouter, and the leaves, as a rule, are set more closely together on the twigs. The leaves are broader in comparison to their length and the petioles are shorter and stouter than those of the other variety. The fruit is broad and flat, pink in color, and larger than that of the Kelabi. In the Kelabi the branches are ascending but they are not so stout as those of the Roumi. As compared with the Roumi, the shoots and petioles are more slender and the leaves and fruits are smaller. The figs are pear-shaped and pale yellow in color.

The Kelabi is never eaten at Cairo, but at Alexandria and in some of the provincial districts the same variety is known as the Beledi or Arabi, and the fruit is used in the same way as the Roumi. The Beledi is usually looked upon as being a distinct variety, but careful comparison of the trees has led us to the conclusion that the slight differences which exist in the shoots and leaves are due to climatic effects in maritime districts.

Figs are found upon the trees at all seasons of the year. In the case of the Roumi, which is the principal variety at Cairo, the young fruits of the first crop appear about the beginning of April. They almost all appear within a period of 4 to 5 days, after which very few fruits are produced until the next crop arises. The first crop is known at Cairo as "Iskat." It is usually a good crop, but not so abundant as the two following ones.

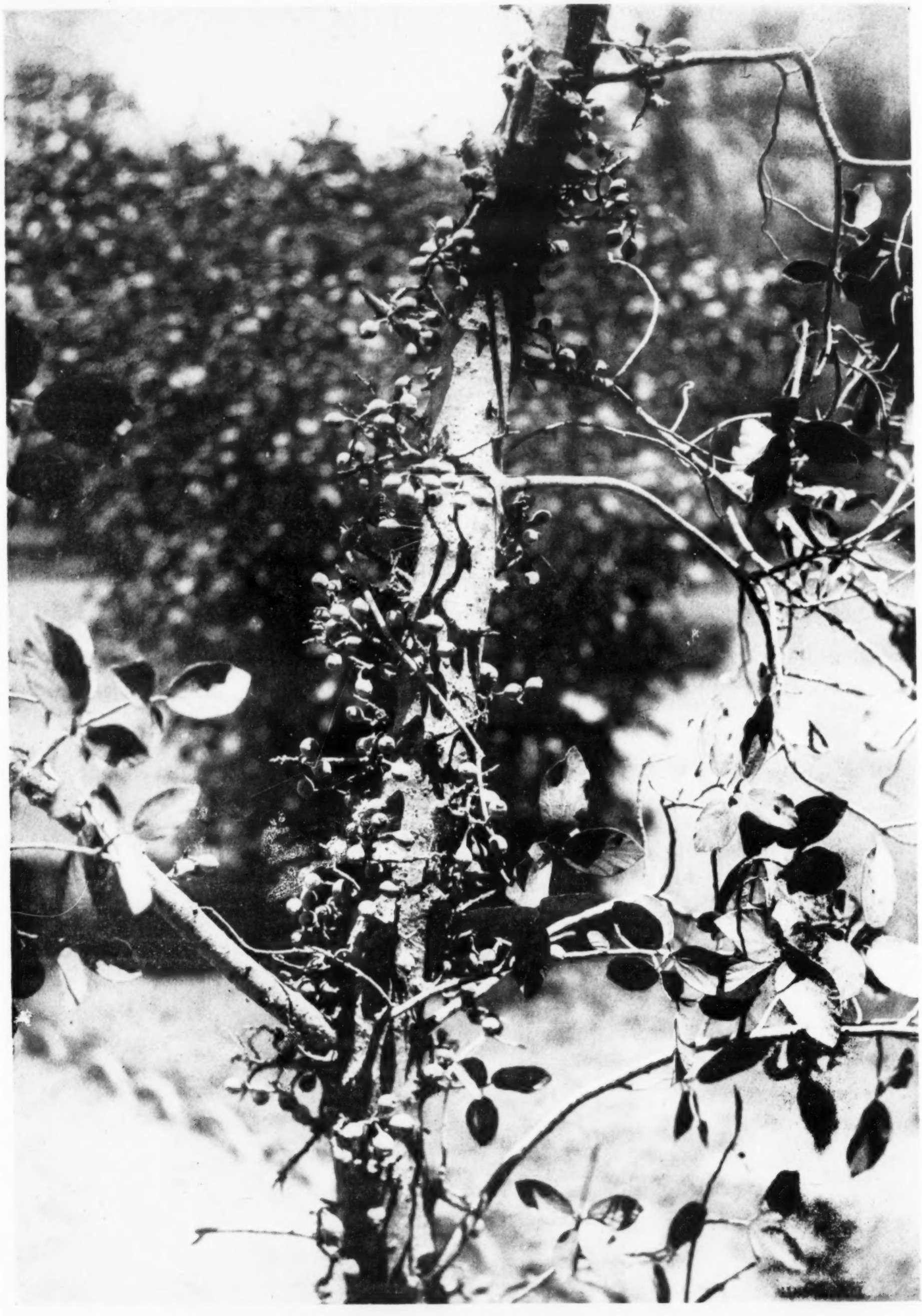
The fruits of the second crop appear as small buttons in the first week of May. This is known at Cairo as "Dor Kamel." It is always a better crop than the first.

The production of young figs during the interval between the second and third crops is more plentiful than during the period between the first and the second crops. Nevertheless the reduction of the number produced at the time is sufficiently great to make the third crop quite distinct from the second. The third crop commences to appear in the first half of June. It is known at Cairo as "Sereya." After the appearance of the third crop there is a continuous but less abundant production of fruit during the autumn and even throughout the winter. Cultivators usually divide this into a fourth and a fifth crop. The fourth is called the "Sayeh" and the fifth is known as the "Dahabiya" crop. There is, however, no definite break in the production of the figs to distinguish the third crop from the fourth and the fourth from the fifth.

Before leaving the question of crops, it is necessary to point out that all the trees of the same variety of sycamore do not act exactly alike: the crop of one tree may not commence to grow until four or five days or even more after that of a neighboring tree. In the case of the Kelabi, the first crop appears later in the season than that of the Roumi.

THE FIG-WASP

What we have said, however, applies in all important respects to the sycamore generally. The fruits of the sycamore are always inhabited by the insect



SYCAMORE FIGS ARE BORNE ON THE OLD WOOD

Most trees bear fruit on the younger twigs and branches, but a few, among which is the sycamore fig, produce nearly all their fruit on older wood. In this case, short, specialized branches are put forth directly from the trunk. The fruit of the fig is almost unique in character, consisting of a fleshy receptacle holding a large cluster of small flowers on its inner surface. These flowers make up the "flesh" of the fruit that is eaten. Each flower contains a single ovule, and the whole receptacle is open to the air at its apex. Through this opening the fig-wasp crawls, and lays an egg in every flower, thus preventing the development of the seed. The sycamore fig is, therefore, propagated artificially, by cuttings, and in Egypt it appears that seedlings are quite unknown. (Fig. 2.)

SYCAMORE FIGS GROWN IN ALGERIA

The Egyptian grower gouges a small hole in the end of the ripening fruit, to admit air and prevent the eggs of the fig-wasp from hatching. The Algerian merely slices the end of the fruit off with a knife. The tree is rare in Algeria. Photograph, natural size, made at Biskra, Algeria, in 1900, by David Fairchild. (Fig. 3.)

Sycophaga crassipes. These little wasps use the ovaries of the flowers as cells in which to lay their eggs and rear their young. After the eggs are laid, each ovary increases in size, in order to accommodate the insect which develops inside. The young insects which first leave the cells are all males; they are wingless and dark brown in color. As soon as they come out they fecundate the females whilst the latter are still in the cells, in which they have been hatched. When the work of fecundation is finished, the females leave their cells and the males die. The latter may usually be found dead in a cluster just inside the "eye" of the fruit in which they have passed their life. The females are shiny black in color, and are furnished with two pairs of wings and a long ovipositor. As compared with the males, they are somewhat short. As soon as the female leaves the cells she makes her way through the "eye" of the fig to the open air. Sometimes she does not come out by way of the "eye" but through a hole which she cuts in the wall of the fruit. This, however, does not occur frequently. As soon as she has escaped from the old fig she flies to another which is still in the early stage of development. Alighting on this she forces her way between the closely fitting scales of the "eye" until she reaches the interior. This operation usually causes her to

lose her wings. The presence of these protruding from the "eye" is a sure sign that the wasps have entered the fig. The presence of a minute hardened drop of sap also denotes the entry of the wasps. When they have reached the cavity of the fig they proceed to lay an egg in each flower, after which they die.

The number of insects which enter each fig varies between two and thirty-six. They are more plentiful in autumn than at any other season. At that time the number of eggs laid in each fruit is at least 1,000. This is the number actually counted, but there must have been many more which escaped observation in the disintegration of the flowers.

In summer the insects enter the figs when the latter are 15 to 20 days old.

CHANGES IN THE FIG

As soon as the eggs are laid, the fig commences to secrete a watery fluid which eventually fills the cavity to about one-fourth of its capacity.

Before the time arrives for the young insects to emerge from their cells, the fluid is again absorbed and the interior of the fig returns to its original condition. The period which elapses between the laying of the eggs and the emergence of the young insects is about a month. The development of the wasps thus coincides with the growth of the figs, so that when the females leave the fruits of one crop, those of the following crop are ready to receive them. This may be represented approximately as follows:

Crop No. 1

Commences growth April 1
Insects enter figs April 15
Young insects emerge May 15

Crop No. 2

May 1, commences growth
May 15, insects enter
June 15, young insects emerge.

As we have already explained, in autumn there is a continuous production of fruits so that whenever the wasps come out of the mature figs they find others of a suitable age in which to lay their eggs. In winter the growth of both figs and insects is slower than in summer.

We have not been able to find seeds in any of the figs. It therefore appears that the only *raison d'être* of the figs is to provide food and shelter for the wasps.

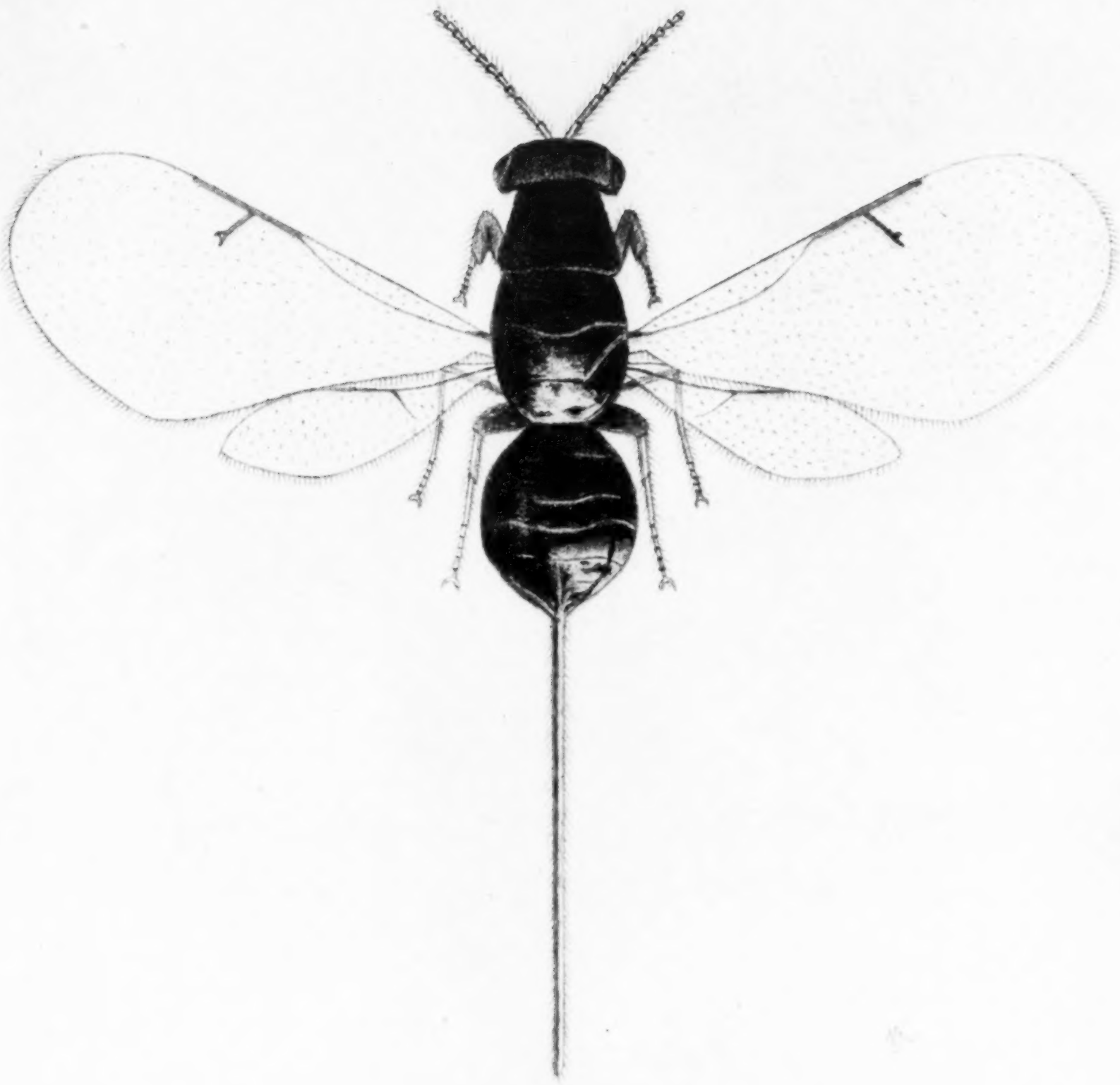
In fact, experiments tend to prove that, in the absence of the insects, the figs are not able to continue their growth beyond the initial stages.

We have surrounded the young fruits with muslin bags and thus prevented the access of the Sycophaga to the figs, and in no case has the usual secretion of liquid taken place inside, but, on the other hand, after the lapse of a few days the figs have shrivelled and fallen. The presence of the wasp, therefore, appears to be an essential condition for the development of the fig itself. We naturally suppose that the use of the fig to the tree in its primitive state was the production of seed for the propagation of the species.

SEEDS SOMETIMES PRODUCED

Sickenberger in his "Contributions à la flore de l'Egypte" states that the tree produces perfect seeds in Nubia, Abyssinia and Yemen. Inquiries made in the first-named country have not enabled us to confirm that statement. As stated by Muschler, Dr. Schweinfurth saw many seedling trees growing spontaneously in the Yemen, so that the tree evidently still retains the power of producing good seed there. The question, therefore, arises: Is the Sycophaga not found in that country and have the figs been adapted to the needs of the insects since the tree came to Egypt? We may also ask whether in that country the seed-bearing flowers exist side by side with others in which the insect breeds, as is the case in the caprifig.

It has been stated that the sycamore insect is that which effects caprification of the common fig in Malta, but this statement does not appear to be based upon fact. In this connection it is interesting to compare the common caprifig insect *Blastophaga grossorum* with the Sycamore wasp *Sycophaga crassipes*.



THE FEMALE SYCAMORE FIG-WASP

This wasp is less than one-eighth of an inch in length; its existence seems to depend wholly on the sycamore fig. Its abdomen terminates in a long, slender tube, the ovipositor, nicely adapted for reaching down into the fig flower and depositing an egg at its base. In crawling through the small opening at the end of the fig, the female usually loses her wings, and subsequently dies. When the young hatch, they develop rapidly, emerge from the fig in which they were born, and the females fly to other figs, where they lay their own eggs and then die. The fact that sycamore figs ripen throughout almost the entire year, makes this life-cycle for the insect possible. While the existence of the fig-wasp is made possible by the tree, it would appear that naturally the existence of the tree is made almost impossible by the wasp, since it prevents seeds from developing in the fruit and the species would, therefore, apparently die from inability to perpetuate itself, were it not propagated by the farmers who want its fruit. (Fig. 4.)

It is found that the ovipositor of the former is quite short, consequently the insect is able to deposit its eggs in the ovaries of short-styled flowers only. The eggs are laid almost entirely in the gall flowers of the caprifig. These gall flowers are female flowers which have become modified and adapted to the

FLOWER OF THE FIG

The "fruit" consists virtually of a cluster of these flowers turned inside out. The flower has a long bottle-neck style; hence the fig-wasp has to have a very long ovipositor, as shown in the preceding drawing, in order to deposit her egg in the ovary of the flower, indicated in outline at the base. (Fig. 5.)

needs of the insect. As compared with the normal female flower the pistil of the gall flower has been greatly shortened so that the caprifig insect with its short ovipositor is able to reach the ovary. The sycamore insect, on the other hand, has evolved a long ovipositor and no modification is apparent in the length of the pistils of the Sycamore flowers.

As we have seen, the sycamore does not produce seed in Egypt, and as it has no means of natural vegetative reproduction, it depends entirely upon human agencies for its perpetuation. Propagation is effected entirely by means of cuttings. The tree is of quick growth, but for its full development it requires plenty of moisture.

When it has become sufficiently old to bear fruit, the fellaheen make a ring around the trunk by beating the bark with a wooden club. A fresh ring is made each year in the month of January, just above the ring of the previous year. This goes on year after year until the entire trunk and larger branches wear the scarred appearance so characteristic of the tree in Egypt. The treatment is supposed to make the tree bear more abundantly than otherwise.

When the fruit is fifteen to twenty days old, a hole 1½ to 2 cm. in diameter is made at the top or in the side of the fig. In Cairo district the hole is circular in shape and is made with a special instrument. This is a ring of flat iron attached to a handle about 6 cm. long. Expert workmen are able to use a cutter in each hand.

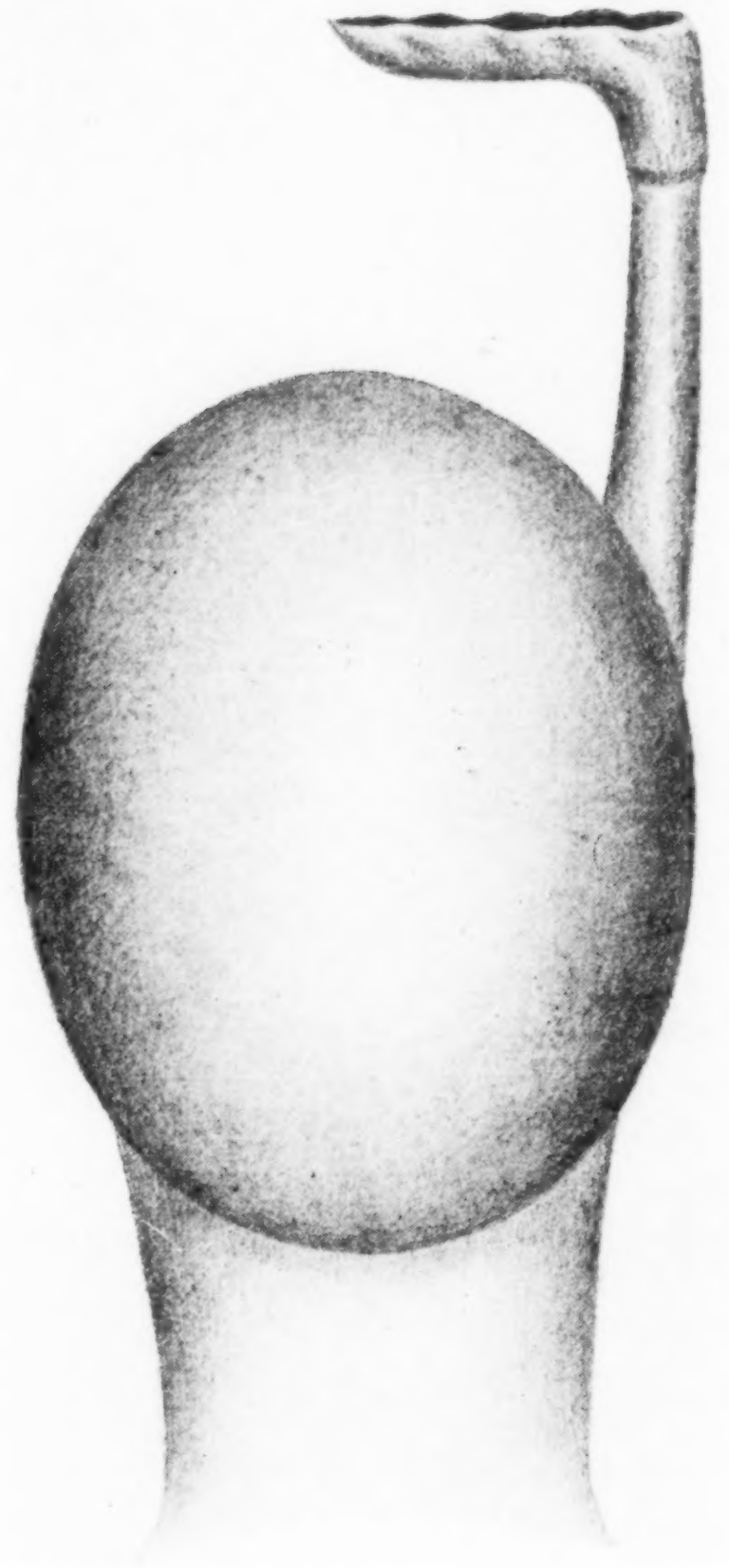
In the provinces, the holes are often made longitudinally with an ordinary knife. The operation of cutting the figs is done by men who are called "gemamzia." Women are sometimes employed also. Both men and women become most expert in climbing the trees and they often remind one of the scenes depicted on the ancient monuments showing monkeys among the branches of the trees. These animals are supposed to have been trained in olden times to gather the fruit and throw it to the men below.

At Cairo the fruits of the first crop are operated upon in the early morning, but in the case of the two succeeding crops, when the weather is hot the operation is carried out in the late afternoon. The work extends over a period of two to three days for each crop, and the fruit is ready for gathering four or five days after the holes have been made. In the Cairo district the figs of the third and following crops are not eaten, but in the provinces

the work of cutting and harvesting continues until the month of November. Fruit which is not operated upon continues its growth and its inner surface becomes covered with expanded flower cells containing the young insects or cells from which the insects have escaped. Figs in this state are known as "badh." Needless to say they are disagreeable to eat. When the young fruit is opened in the manner described above, the influence of the air causes the flowers inside to dry and form a compact mass, in which the insects cannot lay their eggs. The drying effect of the air also stops the development of any eggs which may have been deposited previously. The presence of the fluid which is secreted in the interior of the fig is essential to the welfare of the eggs, and when the air is admitted, the liquid evaporates and all further development is stopped. As already stated, the fruit is afterwards allowed to ripen four or five days, when it is ready for consumption.

The usual explanation of the figs being cut to allow the wasps to escape is not correct. If the operation is postponed until the eggs have been hatched the admittance of the air will not prevent the young insects leaving the cells, but the cultivators are careful not to postpone the work until that time. The branches are usually surrounded with nets as soon as the figs are opened. This protects the fruit from bats and birds, and prevents any of it falling to the ground and being spoiled. It is always collected by hand. All the work in connection with the crop, including the beating of the tree, is done by the "gemamzia" who buy the year's fruit in advance. A good tree brings as much as £1 per year.

The owner of the tree seldom gathers the fruit or sells it by measure, unless in the case of small trees in the fields, where the quantity is not sufficient to attract the merchants.



A DEVELOPING FLOWER

The greatly enlarged ovary of the flower indicates that a young fig-wasp has hatched out and is developing inside. When this takes place, the inside of the fruit fills up with a liquid which it secretes. When the Egyptian cuts a hole in the end of the fruit, this liquid dries up and the fig is rendered edible. (Fig. 6.)

USES OF THE TREE

In olden times the timber of the sycamore appears to have been extensively used in the industrial arts. The wood was seasoned in water to make it hard and unchangeable. Its power of resisting decay when immersed in water is still appreciated and we find that its principal use today is in the construction of wells.

As a tree, the sycamore supports town conditions quite well; it requires severe pruning to keep its spreading branches within the limits of a street

tree. It is more suitable for planting along suburban roads where it has plenty of space to spread out on each side. Nothing is more picturesque than an avenue of sycamores, and as a shade tree in rural districts it is unsurpassed, but the great spread of its branches makes it objectionable in situations where it is in close proximity to cultivated land.

In ancient times the latex of the fig was supposed to be an efficacious remedy in cases of snake and scorpion bites. We are not aware that it is still used in such cases, although the fellaheen often apply it as a remedy for skin diseases.

Miscegenation in Hawaii

Out of 210 American grooms married in Hawaii during 1914, only 53.3% married American women, 11.9% married Caucasian-Hawaiian women, 11.9% married Portuguese women, 5.2% married full-blood Hawaiian women, 1.9% married Chinese-Hawaiian women, 1.4% married full-blood Chinese women, 1.9% married Porto Rican women, and the remainder included British, Filipino, French, German, Japanese, Mexican-Portuguese, Norwegian, Spanish and Swedish women. Dr. Frederick L. Hoffman, who publishes these figures in a pamphlet on The Sanitary Progress and Vital Statistics of Hawaii, says all observations show that the intermixture of native women with full-blood Chinese has produced a physically and morally superior type.

Eugenics as the Basis of Sociology

THE PHYSICAL BASIS OF SOCIETY, by Carl Kelsey, Professor of Sociology, University of Pennsylvania. Pp. 406. Price, $2.00 net. New York: D. Appleton & Co., 1916.

As an introduction to the study of sociology, Prof. Kelsey has compiled what is practically a text-book of eugenics. He has usually followed good authorities and (excepting the weak chapter on racial differences) his biology is on the whole sound. One wishes that Prof. Kelsey had used his sociological knowledge to make an original contribution to applied eugenics: perhaps he will do so in a future volume. The present book will interest biologists as showing what parts of their work most impress a sympathetic sociologist; and if used by other sociologists as it is by the author, to introduce a course in sociology, it will be of much value in giving the student the proper start.

Huntington's Chorea and Heredity

Huntington's Chorea is a form of mental deterioration associated with nervous tremors of the body. Dr. C. B. Davenport and Dr. Elizabeth Muncey have completed a study of nearly one thousand cases, all of which trace back to six individuals, and publish their results as Bulletin No. 17 of the Eugenics Record Office. The defect is highly hereditary, seldom if ever skipping a generation, and is associated with other nervous traits. It does not seem to be dying out through marriage selection; moreover, new sources are coming into the United States at present through immigration. State and federal action to prevent the increase of this serious taint appears to be justified.

Meeting on Saturday Not Open to Public

Dr. C. B. Davenport writes that, because of the limited accommodations at the Carnegie Institution's Station in Cold Spring Harbor, Long Island, invitation to visit it on Saturday, December 30, is limited to the Society of Naturalists.

THE MODERN IDEA OF EVOLUTION

Darwin's Work Corrected and Amplified, But Its Essential Parts Not Supplanted—Cause of Variations Still a Mystery But Manner of Their Inheritance Made Clear

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LOOK at the surface of a pond ruffled by the wind, and you see that it is constantly changing. Its aspect is different in each two successive seconds, and yet after an hour of this perpetual change, the pond looks just as it did when you began to observe it. Ceaseless change here produces nothing new; when the wind dies down in the evening the pond is no different than it was in the calm before dawn.

But ever since men began to leave their thoughts on record, they have made note of the fact that this is not the most usual sort of change. Thinkers have recognized that everything is changing, and that when a living thing changes, it usually becomes something different from what it was before. They have watched the progressive change of a seed to a full-grown plant, of an egg to an adult bird; and men with a historical viewpoint have noted that similar changes occur in institutions and in nations, a small beginning leading through a long series of changes to a new condition, where differentiation took the place of the original simplicity. Greek and Hindu speculators surmised that this condition of progressive change applied to species of animals and plants, one following another, so that from simple beginnings complex creatures finally developed.

This idea of progressive change, of development and differentiation, is the idea of evolution. There is nothing new about the idea—it is not at all a product of modern science. As a philosophical speculation it has existed certainly for several thousands of years, and many attempts have been made to convert it from a pure speculation into a demonstrated theory.

During the past century, the attempt to find an explanation of the way in which evolution might take place has been more persistent than ever before. Four main lines of speculation may be distinguished.

FOUR HISTORIC EXPLANATIONS

1. It has been suggested that the environment acts directly on living creatures and causes changes in them. This view was elaborated about the beginning of the last century by Geoffroy St. Hilaire. He assumed that as the surroundings of a plant or animal change, the plant or animal itself must of necessity respond by a change. He did not assume that the response to the new environment was always a favorable one or, as we say, an adaptation. If it was unfavorable, the individual or the race died out. If it was favorable, the individual or race was able to meet the requirements of its changed surroundings, and survived.

St. Hilaire was unable to secure general acceptance of his theory, because he offered no adequate proof that things ever happened as he described them; yet his conception of evolution contains elements that form the background of our thinking today, and within the last few years his explanation has been revived in a mystical form by the French philosopher Bergson, who has secured for it a certain popularity among laymen—not among biologists.

2. The second of the four great historical explanations appeals to a change not immediately connected with the outer world, but to one within the organism itself. It suggests that any organ or structure of an individual that is much used will increase in size and strength, and this increase will be transmitted to the individual's descendants. Similarly, it is supposed that disuse will

THE GREATEST CONTRIBUTOR TO GENETICS

Around any decaying fruit may be found little red-eyed flies, about one-eighth of an inch long, which are known to science under the name of Drosophila. They are so insignificant that the housewife regards them as hardly even a pest; but to a geneticist they are perhaps the most important insect in the world, for their study has thrown more light on heredity than has that of any other one animal. They are, in fact, practically an ideal subject for study, since they stand confinement well, can be kept indefinitely in a milk bottle with a little overripe banana, and in ten days a single pair of parents will produce a generation of 200 or 300 young. Further, they have a number of well-defined characters that can be followed in heredity, and the number of chromosomes is conveniently small (four). Although geneticists have been searching for ten years to find another equally satisfactory insect, they have failed. Photomicrograph by John Howard Paine. (Fig. 7.)

bring about a decrease in size or strength which will likewise be inherited. This theory of the inheritance of the effects of use or disuse—of the inheritance of acquired characters, to use the customary title—is associated principally with the name of the French zoölogist, Lamarck. It was accepted by Darwin, who made much use of it. It held until a generation ago, when August Weismann discredited it by an appeal to common sense. Today the theory has few followers amongst trained investigators, but it still has a popular following that is widespread and vociferous.

3. There is a third explanation of evolution which has taken protean forms. At one extreme it is little more than a mystic sentiment to the effect that evolution is the result of an inner driving force. The earliest name of prominence associated with it is that of Nägeli; recently the geneticist, William Bateson, has put forward a theory of evolution of somewhat similar nature. The numerous theories of this type may be collected under the title of "The theory of the unfolding principle."

NATURAL SELECTION

4. Darwin and Wallace put forward the last of the great historical speculations about evolution in the well-known theory of natural selection, and the former brought together so much evidence as to win almost universal support from men of science. He appealed to *chance variations* as supply-

ing evolution with the material on which natural selection works. If we accept for the moment this statement as the cardinal doctrine of natural selection it appears that evolution is due (1) *not* to an *orderly* response of the organism to its environment, (2) *not* in the main to the activities of the animal through the use or disuse of its parts, (3) *not* to any innate principle of living material itself and (4) above all *not* to purpose either from within or without. Darwin assumed that small variations are constantly appearing in a species, and that individuals with favorable variations survive and transmit them to their descendants, those with unfavorable variations perish.

Darwin's original contribution was not to demonstrate that evolution existed. That fact had long been recognized in speculation and later received overwhelming proof from comparative anatomy, embryology, paleontology and breeding. All of this evidence showed that living species were related to each other, that they had so much in common as to force the assumption that they came from common ancestors; and paleontology was even able to bring forward some of these common ancestors.

The question was not to show that divergent forms had a common origin, but to explain how they had come to diverge, and Darwin's explanation of the action of natural selection on inheritable variations was generally accepted as accurate. But his attempts to explain (1) the origin of these variations and (2) the manner in which they were inherited met with little success, and as long as these two problems were unsolved, the evolutionist was on uncertain ground.

RECENT PROGRESS GREAT

Biologists, therefore, made a widespread attack on these two problems, and it is the belief of many that within the last decade (2) has been explained and (1) has been considerably elucidated, although not yet solved.

This is the viewpoint taken by Prof. Thomas Hunt Morgan, of Columbia Univeristy, who has brought together in book form[1] four lectures in which he critically examines the theory of evolution. In addition to its intrinsic merits, the book has added interest because, in the first place, Dr. Morgan was one of the first zoölogists successfully to challenge the adequacy of Darwin's explanations, and still more, in the second place, because his own work has been very largely responsible for clearing up problem (2) above-mentioned, the problem of how variations are inherited. The book is simply written, and furnishes the first authoritative account of Morgan's work which is available to anyone but the specialist, Morgan's previous works having been too technical for comprehension by the reader who had no previous knowledge of genetics.

The preceding paragraphs have summed up Morgan's statement of the case. We have evolution as a theory, many attempts to demonstrate it, and finally general agreement that Darwin had demonstrated it successfully. Then we see certain fundamental parts of Darwin's proof challenged and, by many critics, thrown out of court. The questions of (1)how variations originated and(2) how they were inherited had to be attacked again, and they were fundamental to the problem. Dr. Morgan's book is mainly devoted to an explanation of his views on these two points.

We can dispose of the first of these points quickly, for the problem it presents has not yet been solved. Darwin borrowed Lamarck's view, that variations originated through the activities of the animal, and whatever could not be explained by this he admitted to be

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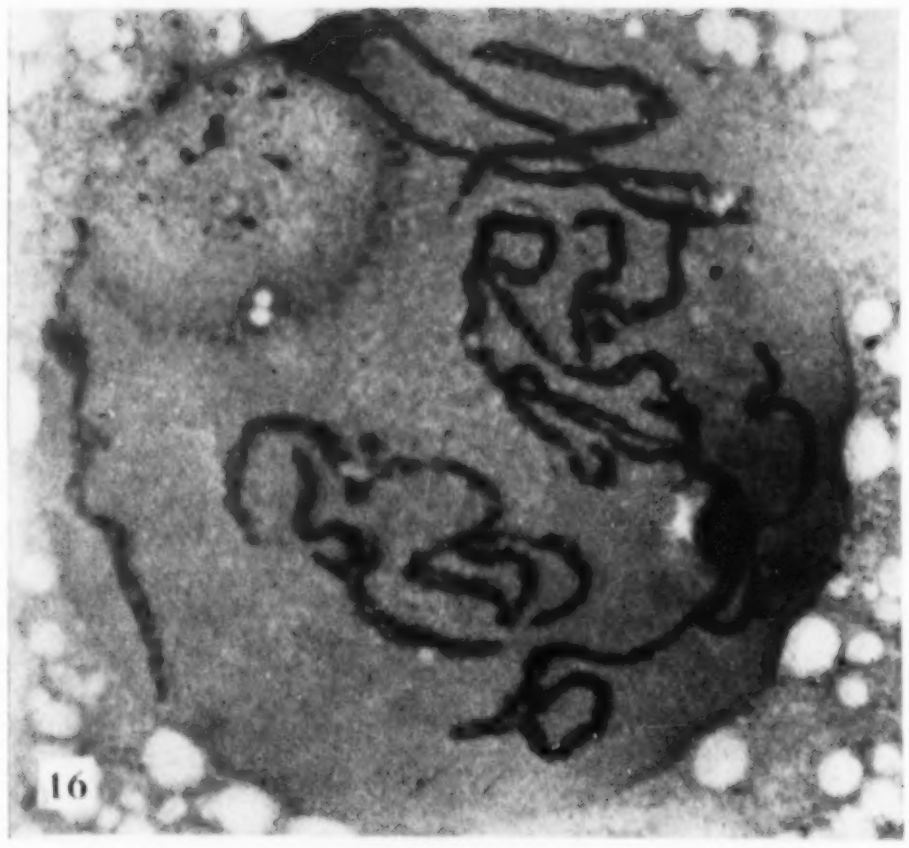
[1] A Critique of the Theory of Evolution, by Thomas Hunt Morgan, professor of experimental zoölogy in Columbia University. Lectures delivered at Princeton University in February and March, 1916. Pp. 197, price $1.50. Princeton University Press. The book is lavishly illustrated with 95 figures, but many of them are hackneyed or inartistic. Someone could perform a great service to evolutionists by getting together a new set of illustrations to take the place of those that have been doing duty so long.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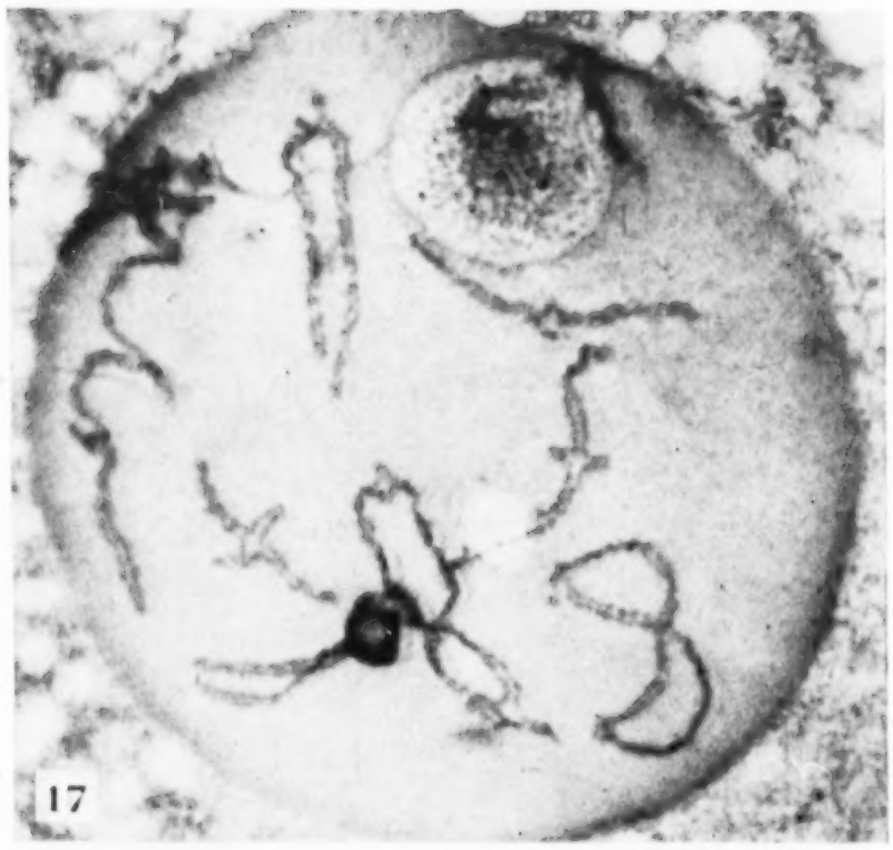
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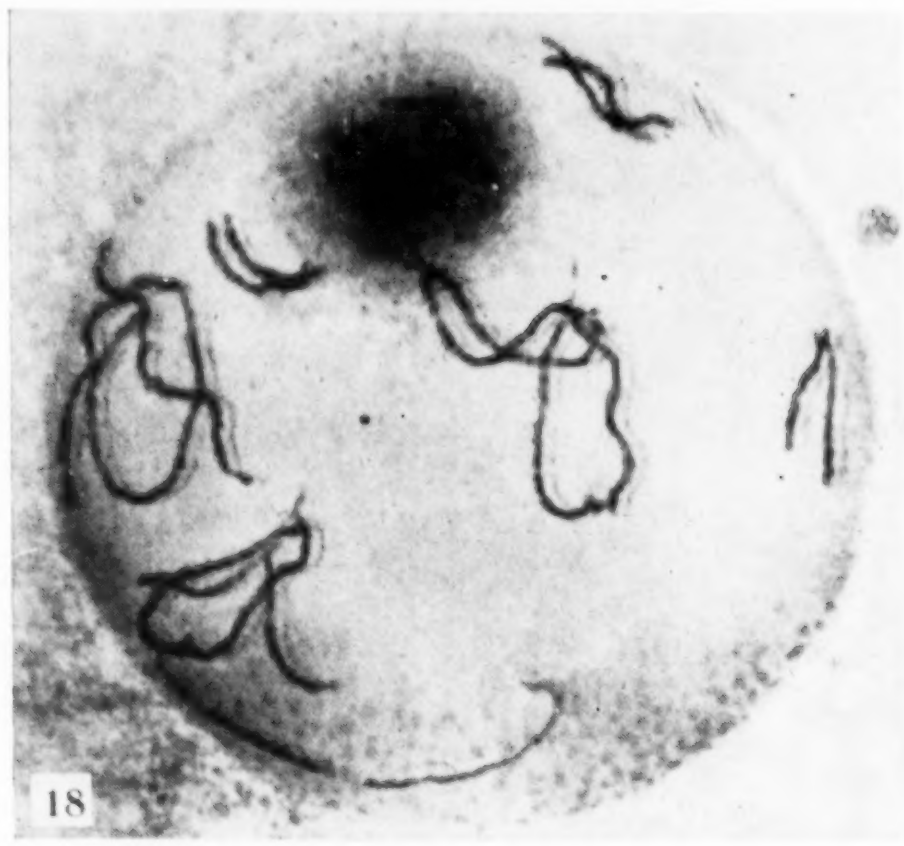
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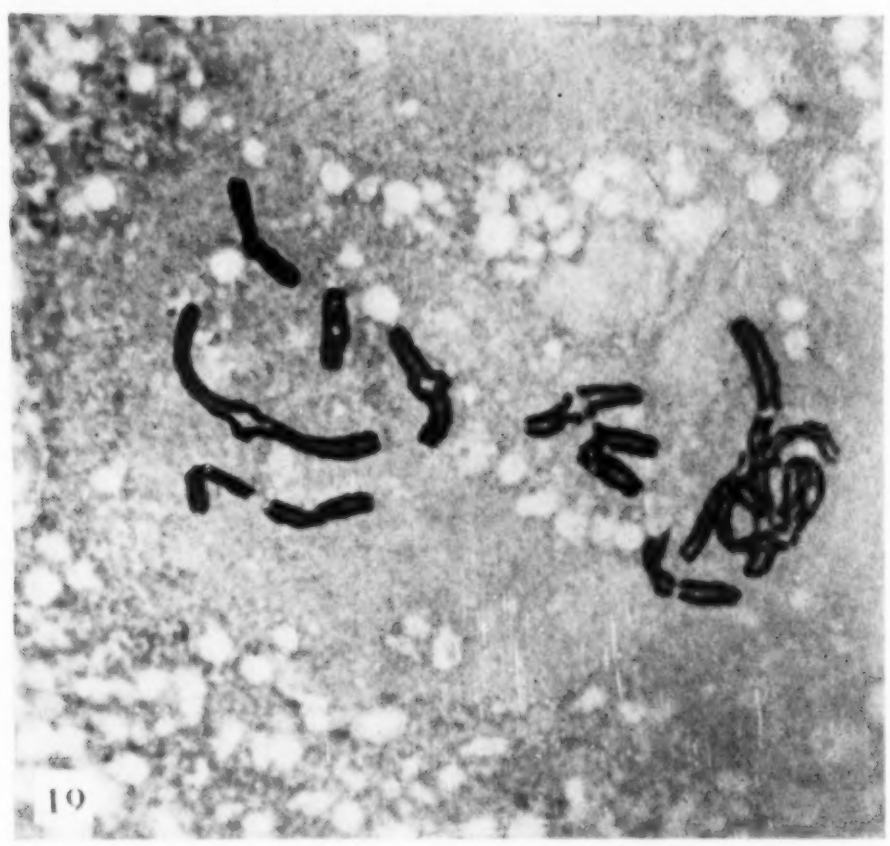
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THE CARRIERS OF HEREDITY

Many different lines of study have made it seem probable that much, at least, of the heredity of an animal or plant is carried in the nucleus of the germ-cell and that in this nucleus it is further located in little rods or threads which can be easily stained so as to become visible, and which have the name of chromosomes. In the above illustration four different views of the nucleus of the germ-cell of an earthworm are shown, with the chromosomes in different stages: in section 19 each chromosome is doubled up like a hairpin. Study of the fruit-fly Drosophila has made it seem probable not only that the hypothetical factors of heredity are located in the chromosomes, but that each factor has a perfectly definite location in its chromosome; and Dr. Morgan and his associates have worked out an ingenious means of measuring the distance from either end, at which the factors lie. Photomicrograph from Foot and Strobell, Archiv. f. Zellforschung V, pl. xii. (Fig. 8.)

at that time unexplainable. We have now thrown out the Lamarckian view, and if we have not been able really to explain how variations arise, we have at least, Dr. Morgan thinks, a truer view of what happens. His discussion of this subject is perhaps the least satisfactory part of the book, but his position is clear enough, being based on the developments of Mendelian heredity.

NATURE OF VARIATIONS

Darwin thought of the individual as a unit, which was undergoing variations in all parts. As a result of experimental breeding, Dr. Morgan says, we must now

abandon this view. The animal itself is not the unit which varies; the germ-plasm of the animal is what varies, and the animal (or plant) is merely the product of (hypothetical) germinal factors. The importance of this change in viewpoint may not be apparent at first sight, but in practice it is found to be weighty, for it substitutes precision and clarity of thought for a wholly mystical idea, and enables us to breed understandingly.

Morgan quotes many instances of variation in the fruit fly Drosophila, on which his work for the last ten years has been mostly based. It is a variable creature; if we catch a bottle full of the same species, we will find that in details they offer numerous differences, and if we go on to breed them we will find that many of these differences are passed on to their progeny. These differences are further found to be inherited in what is known as Mendelian fashion, with which the reader is doubtless familiar.

The point of interest is that every once in a while a fly is born with some character different from the corresponding character of his parents. The parents had normal wings, for example, the offspring comes into the world with extra long wings, and this extra length is found to be inherited in a very definite way.

It is further discovered as the result of long, careful, and widespread observation (Morgan and his associates and students have bred more than half a million flies altogether) that with this change in wing-length go certain other changes in the fly. A change, a variation, seems never to affect one part of the fly alone; it has an indefinitely large number of effects in various parts of the body (and, must we not suppose, on the "mind," too?).

To be strictly accurate, then, we should not say that a certain variation affects length of wing, but that its *chief* effect is to lengthen the wing. "For example, a mutant stock called rudimentary wings has as its principal characteristic very short wings. But the factor for rudimentary wings also produces other effects as well. The females are almost completely sterile, while the males are fertile. The viability of the stocks is poor. When flies with rudimentary wings are put into competition with wild flies relatively few of the rudimentary flies come through, especially if the culture is crowded. The hind legs are also shortened. All of these effects are the results of a single factor-difference.

BY-PRODUCTS OF VARIATION

"One may venture to guess that some of the specific and varietal differences that are characteristic of wild types and which at the same time appear to have no survival value, are only by-products of factors whose most important effect is on another part of the organism where their influence is of vital importance."

"I am inclined to think that an overstatement to the effect that each factor may affect the entire body, is less likely to do harm than to state that each factor affects only a particular character. The reckless use of the phrase 'unit character' has done much to mislead the uninitiated as to the effects that a single change in the germ-plasm may produce on the organism. Fortunately, the expression 'unit character' is being less used by those students of genetics who are more careful in regard to the implications of their terminology."

Now to sum up the new view of the problem of the nature and origin of variations, which Darwin failed to solve. As to the actual cause of these changes in the germ-plasm, we know no more than he did; we suppose them to be chemical reactions. But as to their effects, as to what variation actually means, we have learned a great deal. We have found out that the germinal differences of an individual are inherited separately from each other; that every change in the germ-plasm—*i. e.*, every variation—affects not one but a large number of characters; and conversely, of course, that every visible character is the result of the concurrent action of a large number of factor-differences or variations. It has likewise been demonstrated in many cases

that these variations are inherited in a perfectly definite and predictable way, in accordance with the laws of Mendel.

If the problem of the origin of variations has not actually been solved, we at least have reached a much more exact comprehension of it. We have learned that the animal's own activities can not be invoked to account for variations, and that the environment's direct action cannot explain them. We have seen them to be due to changes in the structure of the germ-cell. It is not certain that we can produce experimentally a single inherited variation—our knowledge is, therefore, much lacking; but the investigators can certainly "report progress," even though it be mainly of a negative kind.

If we turn to the second of the great problems, namely, the way in which variations are transmitted, the nature of the mechanism of heredity, we get a more favorable report. Here are Dr. Morgan's own words:

"THE PROBLEM OF HEREDITY

"I have passed in review a long series of researches as to the nature of the hereditary material. We have, in consequence of this work, arrived within sight of a result that a few years ago seemed far beyond our reach. The mechanism of heredity has, I think, been discovered—discovered not by a flash of intuition but as the result of patient and careful study of the evidence itself.

"With the discovery of this mechanism I venture the opinion that the problem of heredity has been solved. We know how the factors carried by the parent are sorted out to the germ cells. The explanation does not pretend to state how factors arise or how they influence the development of the embryo. But these have never been an integral part of the doctrine of heredity. The problems which they present must be worked out in their own field. So, I repeat, the mechanism of the chromosomes offers a satisfactory solution of the traditional problem of heredity."

It is not necessary here to describe this mechanism in the germ-cells, for an account of Dr. Morgan's work on it was presented in the JOURNAL OF HEREDITY only a few months ago.[2] The germ-cells contain little rods of easily stained material to which the name of chromosomes has been given, and changes that occur in the composition of these rods seem to result in the end-effects which are seen in characters of the animal or plant.

In his last chapter, Dr. Morgan returns again to the doctrine of natural selection, Darwin's principal contribution to the problem of finding how evolution takes place. "In his great book on the *Origin of Species* Darwin tried to do two things: first, to show that the evidence bearing on evolution makes that explanation (*i. e.*, evolution) probable. No such great body of evidence had ever been brought together before, and it wrought, as we all know, a revolution in our modes of thinking.

"Darwin, also, set himself the task of showing *how* evolution might have taken place. He pointed to the influence of the environment, to the effects of use and disuse, and to natural selection. It is to the last theory that his name is especially attached. He appealed to a fact familiar to every one, that no two individuals are identical and that some of the differences that they show are inherited. He argued that those individuals that are best suited to their environment are the most probable ones to survive and leave offspring. In consequence their descendants should in time replace through competition the less well-adapted individuals of the species. This is the process Darwin called natural selection and Spencer, the survival of the fittest."

OBJECTIONS TO DARWIN'S VIEWS

The objections to it, Dr. Morgan says, are (1) that selection can not actually produce anything new and (2) that selection after a while loses its effect. These objections open up controversies which cannot here be pursued. Adopting for the moment Dr. Morgan's views, "The question still remains:

[2] See "Mendelism up-to-date," a Review of "The Mechanism of Mendelian Heredity," by Morgan, Sturtevant, Muller and Bridges. JOURNAL OF HEREDITY, Vol. VII, pp. 17-23, January, 1916.

Does selection play any rôle in evolution, and, if so, in what sense? Does the elimination of the unfit influence the course of evolution, except in the negative sense of leaving more room for the fit? There is something further to be said in this connection, although opinions may differ as to whether the following interpretation of the term 'natural selection' is the only possible one.

"If through a mutation a character appears that is neither advantageous or disadvantageous, but indifferent, the chance that it may become established in a race is extremely small, although by good luck such a thing may occur rarely. It makes no difference whether the character in question is a dominant or a recessive one, the chance of its becoming established is exactly the same. If through a mutation a character appears that has an *injurious* effect, however slight this may be, it has practically no chance of becoming established.

"If through a mutation a character appears that has a *beneficial* influence on the individual, the chance that the individual will survive is increased, not only for itself, but for all of its descendants that come to inherit this character. It is this increase in the number of individuals, possessing a particular character, that might have an influence on the course of evolution."

If the word *variation* be substituted for the word *mutation* in the preceding three paragraphs, the statement would appear to be a good outline of Darwin's own position. The question of how much Morgan's view differs from Darwin's is, then, a question of the difference between Darwin's *variations* and Morgan's *mutations*. To the reviewer, the difference appears one rather of words than of facts. The mutations in Drosophila, which Morgan describes at some length, are many of them exactly the kind of changes which Darwin described as variations.

A DIFFERENCE OF WORDS

If this is a fair statement, then Darwin's work has not been supplanted to anything like the extent that is sometimes supposed. A decade ago, when the mutationists were young and enthusiastic, they gave the impression that they were about to make a great change in the status of natural selection. Darwin's variations were challenged as not being inheritable (as a fact, many of them were not) and mutations were put forward as the real basis of evolution. After ten years of study, it appers that mutation and variation mean practically the same thing. A lot of mere fluctuations have been thrown out, but the concept of mutations as described by Dr. Morgan, while more definite, is not radically different from that of variations which Darwin recognized. That the two parties should now stand so nearly on common ground (whether they recognize it or not) argues well for the validity of the ideas they hold.

Next, does selection of a certain kind of variations lead to the probable appearance of further variations *in the same direction?* Dr. Morgan thinks not. The only rôle of selection is to multiply the numbers of some favorable variation, thus giving it a chance to become established and crowd out the older forms. His conclusion follows:

"The evidence shows clearly that the characters of wild animals and plants, as well as those of domesticated races, are inherited both in the wild and in the domesticated forms according to Mendel's Law.

"The causes of the mutations that give rise to new characters we do not know, although we have no reason to suppose that they are due to other than natural processes.

"Evolution has taken place by the incorporation into the race of those mutations that are beneficial to the life and reproduction of the organism. Natural selection as here defined means both the increase in the number of individuals that results after a beneficial mutation has occurred (owing to the ability of living matter to propagate), and, also, that this preponderance of certain kinds of individuals in a population makes some further results more

probable than others. More than this, natural selection cannot mean, if factors are fixed and are not changed by selection."

Most Mendelians would accept Dr. Morgan's statement as their own. Parts of it would be seriously questioned by other geneticists and by many zoölogists and botanists and all biometricians. But these parts are minor ones, and the essential differences between these various workers appear to be somewhat exaggerated by the use of different names for the same thing.

DARWIN NOT DISCREDITED

If so, it follows that natural selection stands in almost the position where Darwin left it. It is still the only acceptable account of how adaptation takes place, unless one is content to accept a mystical explanation. The past half century has seen the elimination of many false hypotheses; it has brought a clearer idea of the nature of variations and a great increase in the knowledge of how they are inherited; but back of all this is Darwin's principal work—the hypothesis of natural selection—which is substantially confirmed. The reviewer is unable to avoid the conclusion that Dr. Morgan exaggerates the differences between the Mendelian view and the original Darwinian view. Fifteen years of Mendelism have brought much increase of knowledge, and this knowledge has made many ideas of evolution clearer; but it does not seem materially to have changed the theory of natural selection which Darwin built up. As far as the evidence goes, we must still look on evolution as due to the action of natural selection on variations (or mutations), although we have a much clearer idea of the nature of these, and the mode of their inheritance, than was possible to the last generation.

An Early Apostle of Seed Selection

Seed selection is one of the methods most insisted upon nowadays for the improvement of the yield of maize; but the principle involved is not new. The Indians understood and practiced it even in pre-Columbian days. A. D. Shamel has called the attention of this Journal to "Poor Richard's Almanack" for 1812, in which Evan Evans of Washington, D. C., describes the "improved mode" by which he secured from 1 acre of ground, which had not been in cultivation for twenty-five years before, 110 bushels of maize, besides 4 bushels of beans and a quantity of turnips which sold for $16. He lays the most stress on the selection of proper seed, and says that by choosing the largest and fullest ears from the largest stalks he "improved some of the corn from eighteen to thirty-two rows on the ear."

Supposed Degeneration of Vegetables in the Tropics

It is widely believed that northern strains of vegetables, when planted in the tropics, soon deteriorate or "run out." The Porto Rico experiment station has made some tests of this, and reports its results in Bulletin No. 20. It is true that northern vegetables sometimes fail to set seed; in other cases, they are not so well adapted to tropical conditions as are the tropical races; again, they may be planted at the wrong season; finally, the seed loses viability rapidly in the moist, warm atmosphere. All these factors combine to foster the idea that strains of vegetables degenerate; but that such degeneration actually takes place, does not appear from the Porto Rico experiments with peppers, tomatoes, beans, okra and lettuce. Beans of the ninth generation and okra of the eighth were in no way inferior to the first generations.

THE BEST PAPAWS

Superior Fruit Found as the Result of Association's Offer—The Largest Trees —Importance of Proper Maturity of Fruit—Choice Varieties Merit Wide Dissemination

THAT the North American papaw (*Asimina triloba;* not related to the Central American papaya, which is sometimes called papaw) is a more promising fruit than even its admirers have believed, is the opinion of all those who have seen the material sent to the American Genetic Association during the past fall. Better fruits have been discovered than most horticulturists thought possible, and no great difficulty has been found in shipping them. It is hoped that the discovery of these superlative varieties of papaw will lead to their widespread propagation and dissemination.

It will be recalled that the association last spring was enabled, through the generosity of one of its members, to offer a reward of $50 for the photograph of the largest papaw tree and a similar reward for the best papaws. This offer does not expire until January 1, 1917, but as the papaw season is now well past, and contributions have ceased, there seems no impropriety in printing, at this time, the results.

Seventy-five samples of fruit were received, the first on August 18, from Rockway, Tenn., and the last on October 23, from Purcellville, Va. From letters of correspondents it appears that the season extends nearly three months, *i.e.*, from before August 1 to late October.

Reports of 230 different stations of the tree were sent in. They cover almost the whole of the recognized range of the species, as may be seen in the attached map (Fig. 11). It is clear that the tree will succeed in a very large part of the United States.

The best fruit received is considered to be that sent by Mrs. Frank Ketter, of 615 S. Sixth Street, Ironton, Ohio, on September 9. The three largest of the eight fruits weighed 10, 10 and 12 ounces. The latter is the largest size reached by any fruit which the association has received. Numerous reports have been made of fruits that weighed a pound, or even more, but none such was seen by this association. All correspondents agree that the past summer was particularly unfavorable to the development of the papaw in the middle west, because of the long drought, and this may be responsible for the fact that no fruit larger than 12 ounces in size could be secured.

CHARACTERS OF A GOOD FRUIT

Mrs. Ketter's fruit, packed in excelsior, arrived in perfect condition, and had matured very evenly. The skin is comparatively tough and thick and does not discolor markedly; the flesh is medium yellow in color, mild but very rich in flavor, neither insipid nor cloying. The amount and quality of the flesh, together with the good shipping and ripening qualities of the fruit, make this an extremely desirable variety and Mrs. Ketter will be paid the $50 offered for the best fruit. She writes as follows:

"The papaws that you received from me in September were grown in dense thickets consisting of locusts and mulberry trees, and it was impossible to get a good photograph of the tree itself while the foliage was on, for which I was very sorry, as I wanted to try to get *one* of the prizes at least, as I felt that these papaws were the finest around here and so many that go up to our place want to buy some to send to their friends, as they claim they never saw such fine ones.

"The tree is wild, receives *no* attention whatever, and bears well every year. As this tree from which that

THE LARGEST PAPAW TREE

Most people know the papaw only as a shrub, but in this specimen it reaches a really respectable size; and a few other trees not much smaller have been found. The tree above appears to be slowly dying, possibly of old age. But a number of instances have been found where the papaw has borne fruit regularly for sixty or seventy years, and no one knows how much longer. The idea that it is a short-lived tree seems, therefore, not to be wholly true. Photographed near Boonville, Ind., in August, 1914, by C. P. Close. (Fig. 9.)

fruit was taken grows in a thicket it does not have the spread it should.

"The tree bears one-half to 1 bushel and bears annually.

"At the base it measures from 6 to 8 inches in diameter and about 20 feet in height.

"Plenty of twigs could be obtained for grafting and a great number could be obtained for transplanting of smaller trees growing in this thicket which bear the same quality of fruit as I sent you.

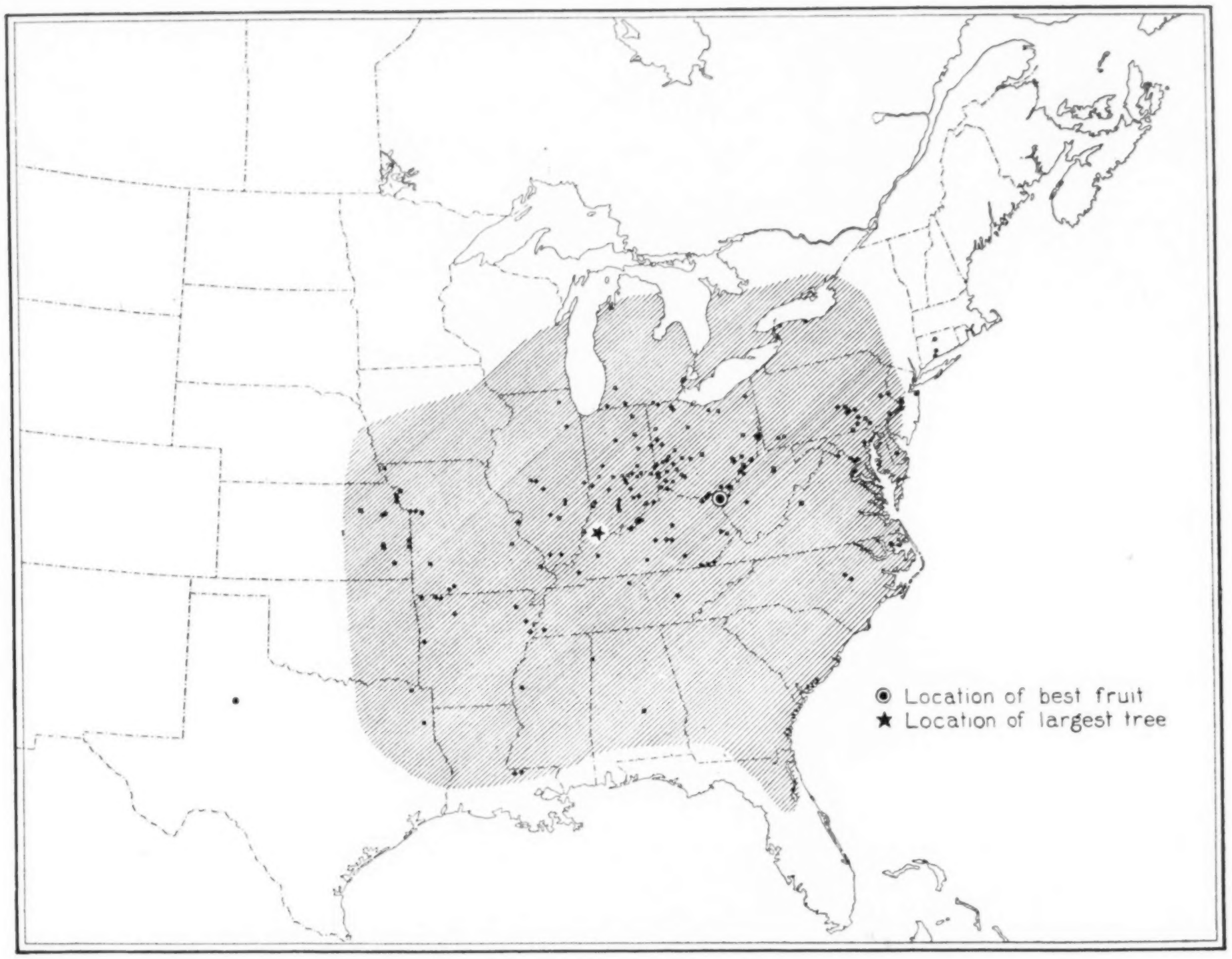
"This tree is located on the hills of Lawrence County in Fayette Township in the most southern point of Ohio."

Six other samples of fruit stood out above all the rest in quality, and are worthy of propagation. They were sent by the following:

John Cheatwood, Gallia, Ohio, September 12. Weight, 10 to 12 ounces. These fruits, whose yellow flesh was very mild and good, came from one of a cluster of four trees about twenty-five years old which, Mr. Cheatwood says, all bear fruit of the same quality, that in most years reaches a much larger size than the above. The group bore about 2 bushels of fruit this year.

S. C. Martin, R. F. D. No. 9, Springfield, Ohio, September 19. Weight 10 to 11 ounces. Flesh yellow and of superior quality, seeds not large, skin tough. Fruit arrived in perfect condition and matured evenly.

William Rees, Jr., R. F. D. No. 3, Pleasanton, Kans., September 19. Weight 8 to 9 ounces. Flesh pale yellow and of good flavor, seeds excep-



RANGE OF THE PAPAW IN NORTH AMERICA

The range shown by shading is that established by the U. S. Forest Service on the basis of all available previous information. Correspondents of the American Genetic Association have contributed about 230 new stations, which are shown by dots on the map. They cover almost every portion of the accepted range, but only in a few cases go beyond it. The absence of reports from some parts of the range may show that the papaw does not grow to perfection there, or it may merely show that the offer of the association was not widely advertised in those regions. Map prepared by the courtesy of the Forest Service. (Fig. 11.)

tionally small. Although not a large fruit, this ships well and has good quality. They come from two trees in the bend of a creek, on "made soil."

Edward Oswald, Hagerstown, Md., October 2. Weight up to 11 ounces. Flesh yellow, flavor good; shipped well and matured evenly. These fruits were grown on a tree which Mr. Oswald transplanted from the woods to his farm, and to which he has given some care.

Dr. B. S. Potter, Julietta, Ind., October 5. Weight 7 to 8 ounces. Although a small fruit, this one has a mild and satisfying flavor, and ships fairly well; it is also late in maturing, which may be an advantage commercially. Flesh a rich yellow in color. Dr. Potter writes that he had one fruit this year which weighed 14 ounces, and adds, "In 1911 I produced three papaws in one cluster, each weighing slightly more than 1 pound. I have more than an acre of papaw trees, from 6 to 10 inches in diameter, and all, save one, bearing fruit of the variety sent you. This grove produces annually from 15 to 25 bushels. It is not an uncommon thing to gather 3 bushels of a morning. They begin ripening as early as August 6. My trees have not missed bearing in abundance for the last seven years. In 1911 I sent 2

THE LARGEST WILD FRUIT IN NORTH AMERICA,

The papaw produces, even in the wild state, an occasional fruit which compares favorably with our long-cu
papaw, as the cultivated apple is than a wild crabapple. The original wild apple was probably much
tors, and the same holds true of most of our cultivated fruits. The papaw has had no systematic i
suppose that a little attention from horticulturists would result in the production of a distinctl
members, to locate a number of the best trees in the country, with the hope that fruit growers will
thick enough skin to ship well. They have a mild and seductive flavor, with the characteristic papaw
that temperate-zone pomology can furnish. Cultivation may be expected to improve the good qual
probable that the size of the fruit can be still further increased, since specimens have often been repor
to have been too dry to bring out these large fruits. A good tree should bear from 50 to 100 fruits
the Office of Foreign Seed and Plant Introduction, U. S. Department of Agriculture. (Fig. 10.)

AMERICA, YET ALMOST UNKNOWN TO HORTICULTURISTS

th our long-cultivated European fruits. The fruits from these desirable trees are as much better than the common robably much inferior to even the crabapples we know today. The pear is an equally great improvement on its ances- systematic improvement and yet produces such fruit as that shown, natural size, above. Is it not reasonable to cf a distinctly superior fruit? This association believes so and has been able, through the generosity of one of its growers will propagate these good strains by grafting. These best fruits are not only large and meaty, but have a eristic papaw aroma, but not to an excessive degree; eaten with sugar and cream they offer one of the richest dishes the good qualities of the fruit, and lessen its defects, reducing the number and size of the seeds, for instance. It is en been reported which weighed a pound—*i. e.*, a third as much again as the above, although the past summer seems to 10 fruits like the above, regularly every year, beginning three or four years after it is set out. Photograph by (Fig. 10.)

TRUNK OF THE GREAT PAPAW

Close view of the prize-winning specimen near Boonville, Ind., showing characteristics of the species. Dendrologists agree that the wood of the papaw is light, spongy, and of little value, but it is said to have been somewhat used for building purposes in the southern States. When freshly cut it shows beautiful yellowish and greenish tints, and gives out an easily recognizable odor. Photograph by Thomas P. Littlepage. (Fig. 12.)

bushels to Los Angeles, Cal. They reached their destination in perfect shape. Later I sent several hundred choice papaw seeds to Artesia, Cal., where I now have a fine lot of trees.[1] The trees readily sell at $1 per tree."

J. C. Roach, De Kalb, Mo., October 12. Weight 7 to 8 ounces. This fruit is of unusual shape, very long in proportion to its breadth, sometimes almost like a banana in form. The quality is good, but not equal to that of the others here listed; as a shipper, however, it is perhaps the best of all, the skin being notably tough and thick. The fruits (eighteen in one box) all arrived intact, although they were quite ripe, had been on the road three days or more, and were protected only in a few cases by a light wrapping of tissue paper. Mr. Roach states that his pasture contains eight or ten large trees of this quality, as well as many seedlings, and that he will be glad to furnish seedlings or twigs to those who wish to propagate the variety.

Most of the papaws received came from wild trees or bushes, but a few people have already taken up the cultivation of the fruit. Benjamin Buckman, of Farmingdale, Sangamon County, Ill., sent a box with a number of named varieties from his grove, as follows:

Cheeley, secured from and named after Jefferson Cheeley of Iuka, Ill.
Hann, from Arkansas.
Early Best, secured from W. C. Stout of Indiana.
Arkansas Beauty.
Scott, secured from C. S. Scott of West Virginia.
Endicott, from George Endicott, Villa Ridge, Ill.
Hope's August, from Anthony Hope of Paint, Ohio.
Hope's September.
Uncle Tom, from J. A. Little of Cartersburg, Ind. This is probably the first named variety of the papaw on record.

None of these fruits was larger than 7 ounces, and they were not ripe enough to allow a fair judgment of their quality.[2]

The largest tree found by this association is 4 or 5 miles southeast of Boonville, Warrick County, Ind. It was found and described by T. P. Littlepage, of Washington, who also sent photographs of it; but his photographs did not comply with the conditions of the association's offer, as they did not show the tree in foliage. C. P. Close, of the Bureau of Plant Industry, Washington, had a photograph of the same tree in full foliage, which he submitted at the request of Mr. Littlepage and, with the consent of the latter, the $50 to be paid for the largest tree will go to Prof. Close.

Ordinarily the papaw does not reach a larger diameter than 1 foot. This specimen, shown in Figs. 9 and 12, is 6 feet 6 inches in circumference at the base, 5 feet in circumference at 3 feet above the ground, and 25 feet high. It appears to be dying now, although it still bears a few fruits; Mr. Littlepage attributes its decline to the fact that the pasture in which it stands is growing up in blue-grass sod. He states that a still larger tree, 5 feet in circumference shoulder high, is lying on the ground near it, having been blown down a few years ago; and he mentions another flourishing tree northeast of Boonville which he says is about 4 feet in circumference.

Other good records were sent in by:

George Yaeger, Salamonia, Jay County, Ind., 40 inches in circumference.

George W. Harp, New Paris, Preble County, Ohio, 40½ inches at 20 inches above the ground.

William D. Hewitt, 671 Bullit Building, Philadelphia (tree at Burlington, N. J.), 38 inches at 2 feet above ground.

J. C. Roach, De Kalb, Mo., 38 inches at 4 inches above ground.

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[1] G. P. Rixford, of San Francisco, states that he has found bearing papaw trees at Santa Barbara, Loomis, Berkeley (University grounds), Miller and Lux Ranch, Forest Ranch P. O. (near Chico), and Coloma (Sutter's Mill, where gold was first discovered), in California, and that some of these fruits seem to him of better quality than any eastern papaws he has eaten.

[2] Mr. Buckman's orchard contains altogether twelve named varieties of papaw. In addition to those above mentioned, he enumerates Cox's Favorite, Early Cluster, and Propst Early.

THE PAPAW RAPIDLY SPREADS

Whether planted or wild, the papaw spreads rapidly by means of suckers from the roots, which sometimes prove to be a great nuisance. At the right of the above tree, near the corner of the shed, can be seen a number of these suckers. If unmolested they will soon form a thicket, as shown in the succeeding illustration. The tree above is located near Maytown, Lancaster County, Pa., and is about 35 years old. It measures 35 inches in circumference at 2 feet from the ground and bore 1½ bushels of fruit last August. Photograph from Mrs. Joseph P. Draper. (Fig. 13.)

F. C. Jordan, Allegheny Observatory, Pittsburgh, Pa., 35 inches.

Helen L. Trice, R. F. D. No. 7, Heltonville, Ind., a double tree which measures 62 inches in circumference at 6 inches above ground. One fork is 37 inches in circumference, the other 33. It is not clear from the photograph whether this represents one tree which has forked, or two trees which have grown together.

The wood is light yellow, with a specific gravity of only about 0.40. Dendrologists invariably describe it as weak, soft, and worthless, but W. T. Coleman, of Bono, Ark., writes that he knows of a house in which all the rafters and joists are made of papaw, and that in earlier times it was much used for barn logs. The inner bark is said to have been used for making nets.

LIFE OF THE TREE

The tree is generally described as short lived. W. D. Hewitt believes that the trees on his property at Burlington, N. J., are at least 80 years old. "I know of one patch," says R. R. Bane, of Wellsburg, W. Va., "the trees of which must be nearly 100 years old, as I am 59 myself and the trees were large when I was a boy." James

Mooney, of Martinsville, Ohio, says, "I know some trees about here that are 8 or 9 inches in diameter, the owner of which tells me he gathered papaws from them sixty years ago, and they look as though they might live sixty years longer." Mr. Mooney continues:

"We have several distinct varieties growing about here: the small early yellow, the large oblong yellow and several kinds of large white papaws. The little yellow will be ripe in a few days or about the twentieth or twenty-fifth of August, while others will not be ripe until September, October and as late as the latter part of November—in fact I have found good papaws under the leaves as late as December.

"We live on one of those beautiful ridges or watersheds that separate the white swamps from the highlands. Papaws will not grow in the swamps with the exception of the foothills of creeks and rivers. It seems to prefer the uplands where grow sugar trees and black ash, and in the kind of soil that supports May apples and ginseng—a rich, brown loam with a good covering of leaf mold. The papaw is one of the slowest growing trees I ever saw and is inclined to be a little cowardly when growing in company with other forest trees that crowd it out or shade it too much. It will thrive better in thin woods where all other underbrush has been cut out, and where the overhanging boughs do not interlace and cut out the sunlight. I do not know of any insect that destroys the papaw tree and none that attacks the fruit except the little black and yellow beetle that bores into the fruit after it has fallen to the ground; and I believe that I know of no animal except man and the opossum that would eat a papaw—with the exception of a small rat terrier dog that follows me in my rambles in the woods and meadows; I do not believe he eats them because he has any particular love for them but just to show his faith in me, as he eats only those I give him.

"Here are some things to remember when planting papaw seed: that it is one of the most tender and brittle trees and needs a good windbreak to parry off the wind storms that will surely come and strip it of branches and foliage; and that the best papaws grow in the richest soil, the primitive soil—I mean the kind of soil where logs have rotted and where the land slopes sufficiently to let the water drain off."

Miss C. V. Krout, of 218 West College Street, Crawfordsville, Ind., adds the following notes:

"In our yard are two groups of papaw trees which have been continually grown for about fifty years. Of course they have died out from time to time, but never all at once, and have renewed themselves by sprouts and seeds. We have never cultivated them, and are of the opinion that pruning and cultivation are hurtful to them.

"The papaw sprouts annoyingly, and in three years these sprouts will bloom, if thrifty, but bear sparingly until about five years old. When they are about twenty they are at their best as producers of fruit. They are the only shrub-tree—if I may coin a name—which has a dark brown bloom, so like the Calicanthus it is often mistaken for it; the bloom of the Indian Arrowwood and the Wake-Robin are of the same color. In the woods about here they grow in deep soil with a carpet of moist leaves around their feet, but ours have a very sunny exposure—in sunlight all the day."

Most of the correspondents grow them from seed, by planting the entire fruit, and then thinning out the less thrifty seedlings. Under favorable circumstances they are reported to bear in the third or fourth year after planting.[3] The yield is variable: one tree is described which was carrying about 400 clusters, with 4 to 6 fruits in a cluster.

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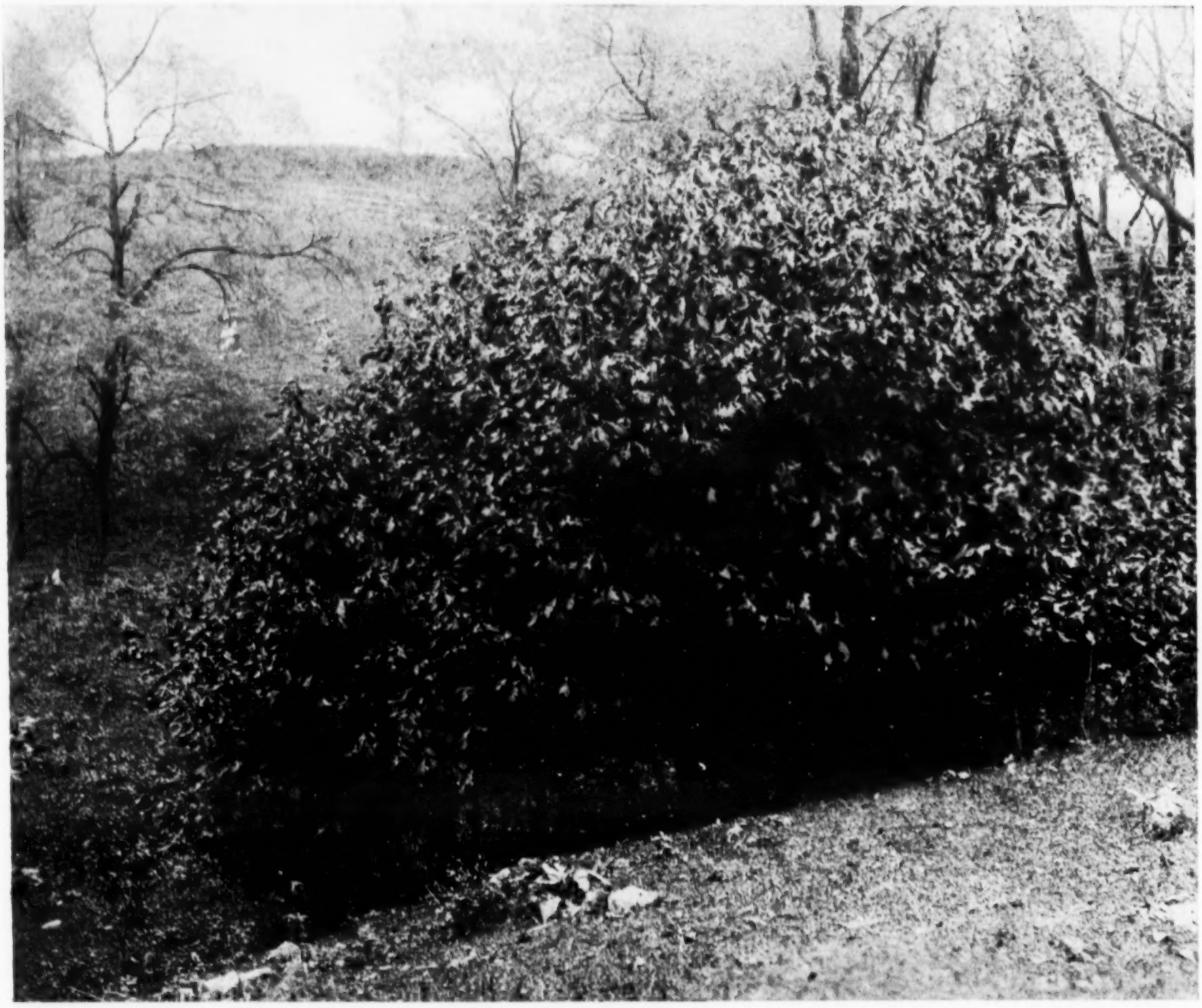
[3] Actual commercial plantings of the papaw seem to be few. There is, or was, an orchard of thirty-five trees at Danville, Ind., which the late James A. Little planted for the late Judge John V. Hadley of the Indiana Supreme Court; and an orchard of more than 100 trees belonging to L. Swartz at Charleston, W. Va.



THE PAPAW IN A STATE OF NATURE

Most people know the papaw, not as an isolated tree, but as a shrub growing in dense thickets like the small one above. Such a thicket may start with a single seedling, or all the seeds in one fruit may sprout and grow close together. As the trees grow, they send out suckers from the roots, as shown in the preceding illustration, and so gradually extend their area. From time to time the older trees die, but their places are taken by new ones, so that the thicket rarely diminishes in size, but always tends to enlarge. In some of the southern States tracts of many hundreds of acres are covered by thickets of this character. Usually the closely crowded trees do not bear such good fruit as those that are isolated and have more light; yet the best fruits received by this association came from just such a thicket as that shown above. Photograph made in Lancaster County, Pa., by Mrs. Joseph P. Draper. (Fig. 14.)

A good tree appears to bear 50 to 100 fruits. It is certain that the size of the fruit could be considerably increased if the tree were gone over in the early summer and all the fruits picked off except one in each cluster. At present the sale is local and apparently not great, and the price is low. H. S. Bomberger, of Palmyra, Pa., states, "I always ship the fruit in berry crates in quart boxes and get $5 a bushel for them."

Occasionally some one is found who is subject to poisoning by the papaw. Benjamin Buckman writes, in sending a shipment of fruit, "I had to pack this box in an outhouse, and wash my hands and face thoroughly in soapy water, because one or two in my family are affected by a single ripe papaw in the room, as badly as the most virulent case of poison ivy I have ever seen, and sugar of lead (often used in ivy poisoning) has no effect on the poison what-

ever." Prof. M. A. Barber, of Kansas University, who studied this poisoning, concludes[4] that it is dependent on a constitutional idiosyncrasy, some people being affected by papaws just as some people are poisoned by strawberries, or oysters. The degree of ripeness of the fruit seemed, in his case, to make some difference in the effect. The poison appears to be in the skin of the fruit, not in the flesh, and there is no record of unpleasant consequences from eating the fruit, which seems to be of a particularly wholesome character.

All of the fruit received by the association had yellow flesh, but it is certain that white-fleshed varieties exist, as almost every correspondent who has had any extended experience with the papaw mentions them. They are distinguished most clearly by Prof. Stanley Coulter:[5]

"Two forms, not separated botanically, are associated in our area. They differ in time of flowering, in size, shape, color and flavor of the fruit, in leaf shape, venation and odor and in color of the bark. They are of constant popular recognition, never seeming to intergrade." The white fleshed fruit is generally said to be inferior, and this probably accounts for the fact that no such fruits were sent to the association. It is also said by some correspondents to be larger. It is very probably a distinct subspecies, if not a good species. The papaw's genus, Asimina, has not been exhaustively studied, but already six or seven distinct species have been constituted in it. With the exception of the papaw itself, they are all small shrubs. One of them, *A. speciosa* of Georgia and Florida, has an ornamental yellowish-white flower, and might be crossed on the papaw with a view to making the flower of the latter more conspicuous.

In general, it is not certain that much is to be expected from hybridization of the papaw. None of the other members of the genus is of commercial value, and the members of the family, the Annonaceae or Custard Apples, are mostly tropical. Commercially the most promising cross would seem to be with one of the Annonas—the delicious South American Cherimoya, for example, whose fruit sometimes reaches a weight of 5 pounds. But there is a considerable obstacle to the success of this cross, in the fact that the fruit of the papaw is a simple berry, while that of the Annonas is compound by the coalescence of the ripening ovaries. The cross is worth trying, nevertheless, for success would be of great importance. G. P. Rixford reports that the cherimoya has been successfully grafted on papaw roots at Santa Barbara, Cal., and this may make possible an extension of the growth of the Annonas north of their present limits. At present they are hardy only in Southern California and Florida, while the papaw is hardy as far north as the Great Lakes and Connecticut.

At present the papaw seems little used except to eat raw or to make by fermentation a rather bitter beer. Its addition to custard pie produces a satisfactory effect. Dr. C. F. Langworthy, of the U. S. Department of Agriculture, who tested its possibilities, concludes that the best way of treating it is to beat the flesh up with cream. It also makes a delicious ice cream.

It is the opinion of those who have handled the fruits sent to the American Genetic Association, that the papaw's reputation would be much better if it were eaten at the proper stage of maturity. It is by many supposed to be eatable only after it has hung on the tree for some time, when the flesh becomes dark in color and slightly fermented. In this condition, however, it seems to the writer and his associates to be really unfit to eat. The fruits that have given the greatest satisfaction are those that were picked just as they began to soften, and allowed to ripen in a cool temperature. Some that were

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[4] Barber, M. A. Poisoning Due to the Papaw (*Asimina triloba*). Journal of the American Medical Association, December 30, 1905.

[5] Report of Indiana State Geologist, 1899, p. 745, quoted in Eleventh Annual Report, State Board of Forestry, Indianapolis, 1912.

THE ORNAMENTAL FORM OF THE PAPAW

When given sufficient space, the papaw heads up into a shapely tree which is an ornament to any lawn. Its large leaves have a distinctly tropical appearance and its flowers, although not conspicuous, are attractive. It is notably free from infestation by insects and little susceptible to plant-diseases. Being hardy over a wide area, it can be strongly recommended for planting wherever room is available. (Fig. 15.)

quite hard when received at this office were placed in a refrigerator and after two weeks were found to be in a perfect condition for eating. It is probable that varieties differ in the evenness of their maturity; but assuming that the variety be a good one, it seems likely that it should be picked before fully ripe and allowed to mature indoors. Experiment would easily determine the proper conditions. Several persons who previously despised the papaw were quite converted when given fruits that were not overripe. If this idea of maturity of the fruit is sound, it offers considerable advantages commercially, since the fruit can be picked and shipped while still firm, and allowed to ripen after its arrival at market.

While hybridization offers some interesting possibilities in improving the papaw and reducing the number or size of seeds, it seems likely that simple selection will give quicker good results. If seedlings or inferior trees are grafted to such superior varieties as are described at the beginning of this article, the esteem of and demand for the fruit should increase rapidly.

Seeds should be planted while fresh, and are excessively slow in growing, sometimes not appearing until a year from the following spring. If given good care they then make fairly rapid growth, and may be transplanted when 12 to 18 inches high. This is preferably done when they are dormant, but has been done successfully when they are in full leaf; the secret is to take up a very large ball of earth around the roots. They should be grafted early in the spring. It is commonly supposed that they thrive best with some shade but a number of experiments show that they do well in full sunlight. The soil should be well drained, and can hardly be too rich. The tree is notably free from diseases and pests, and is desirable for ornamental as well as commercial planting. Its large, dark, handsome leaves make it a striking landscape tree for lawns of considerable size. Planted anywhere within the range shown on the attached map, it should succeed; and if it is grafted to a good variety, given sufficient fertilizer, not allowed to bear too many fruits in a single cluster, and these fruits properly matured, it can hardly fail to please.

A New Text-Book of Genetics

GENETICS AND EUGENICS, a text-book for students of biology and a reference book for animal and plant breeders, by W. E. Castle, Professor of Zoölogy in Harvard University and Research Associate of the Carnegie Institution of Washington. Pp. 353. Illustrations 135. Price, $2.00 net. Cambridge, Mass., Harvard University Press, 1916.

Dr. Castle's book is notable not only because of its contents, but because it is the first comprehensive advanced text-book of genetics in the English language. It contains a general discussion of evolution and the historical explanations of it, devotes a short and somewhat inadequate chapter to biometry, and then discusses Mendelism at length, principally from the animal breeder's viewpoint. Dr. Castle's treatment of all disputed subjects is frankly critical, a fact which adds much to the value of the work; it is also practical, lists being given of the unit characters so far isolated in domestic animals. The treatment of eugenics occupies forty-four pages, is conservative throughout, but particularly sound in its treatment of Mendelism in man. A good bibliography is added, and a reprint of the R. H. S. translation of Mendel's original paper; according to those who have compared this translation with the original, it needs revision. But on the whole the book is admirable both in plan and execution and will be indispensable to every serious student of genetics.

THE GREAT RACE PASSES

Nordic Peoples, Who Have Ruled Occidental World for Many Centuries, Succumbing to War and Competition of Other Races—A Recasting of European History in Terms of Race Instead of Nationality and Language, by Madison Grant

THE "Aryan race" is now extinct. It is only a few years ago that his descent from this great, prehistoric, pastoral race was taught to almost every student in civilized countries. It had been found that people in various parts of Europe and Asia spoke related languages; it was evident that these languages probably derived from a common source, and it was thereupon assumed that the races which spoke them must equally derive from a common source.

With the progress of biology, comparative linguistics is no longer the sole guide to knowledge of the races of man. It is abundantly proved that the various races with Aryan tongues are quite dissimilar, and often have little or nothing in common except their language.

Although the fallacy of the "Aryan race" has vanished, a great number of similar fallacies yet remain. History has rarely been written by biologists: indeed, the biological view of history is the product of only the last few decades. It is not surprising, then, that most readers unconsciously confuse race, nationality and language. Few hesitate to think and speak of the Germans as if they were one homogeneous people. Yet although the Prussian and Bavarian have the same language and nationality, they are much more distantly related than are the Prussian and Scot, or the Bavarian and North Italian.

Now this confusion of thought, and this ignorance of race distinctions, have much more than academic importance; for "race has played a far larger part than either language or nationality in moulding the destinies of men; race implies heredity, and heredity implies all the moral, social and intellectual characteristics and traits which are the springs of politics and government." The idea that nationality and language are the important factors in the classification of men goes with the now discarded idea that changes in the environment will change the inborn nature of men. General adoption of the modern biological viewpoint demands that differences in nationality and language be regarded as secondary and changeable, and that the more permanent genetic differences in race be more carefully studied; and, it may be added, further social progress seems to depend largely on the general adoption of the modern biological viewpoint.

A NEW VIEW OF HISTORY

Such a book as that of Madison Grant[1] on "The Passing of the Great Race" is, then, well worth while. It is "devoted to an attempt to elucidate the meaning of history in terms of race; that is, by the physical and psychical characters of the inhabitants of Europe instead of by their political grouping, or by their spoken language." The book contains little with which specialists are not familiar, but it supplies a readable account of recent work to those who do not follow the publications of specialists. In the field of genetics the author makes some misstatements, but in the field of anthropology he has followed the latest authorities and, although many of the points discussed are still open to contro-

[1] The Passing of the Great Race, or the Racial Basis of European History. By Madison Grant, Chairman, New York Zoological Society; Trustee, American Museum of Natural History; Councilor, American Geographical Society. Pp. 245, 3 charts and 4 maps; price $2.00. New York, Charles Scribner's Sons, 1916.

versy, his guidance is as trustworthy as that of anyone.

He starts as far back as possible.

"Man's place of origin was, undoubtedly, Asia. Europe is only a peninsula of the Eurasiatic continent, and although the extent of its land area during the Pleistocene was much greater than at present, it is certain, from the distribution of the various species of man, that the main races evolved in Asia long before the center of that continent was reduced to deserts by progressive dessication.

"Evidence of the location of the early evolution of man in Asia and the geologically recent submerged area toward the southeast is afforded by the fossil deposits in the Siwalik hills of northern India, where have been found the remains of primates which were either ancestral or closely related to the four living genera of anthropoids; and by the discovery in Java, which in Pliocene times was connected with the mainland over what is now the South China sea, of the earliest known form of erect primate, the Pithecanthropus. This apelike man is practically the 'missing link,' being intermediate between man and the anthropoids. Pithecanthropus is generally believed to have been contemporary with the Günz glaciation of some 500,000 years ago, the first of the four great glacial advances in Europe."

"Man existed in Europe during the second and third interglacial periods, if not earlier. We have his artifacts in the form of eoliths, at least as early as the second interglacial stage, the Mindel-Riss, of some 300,000 years ago. A single jaw found near Heidelberg is referred to this period and is the earliest skeletal evidence of man in Europe."

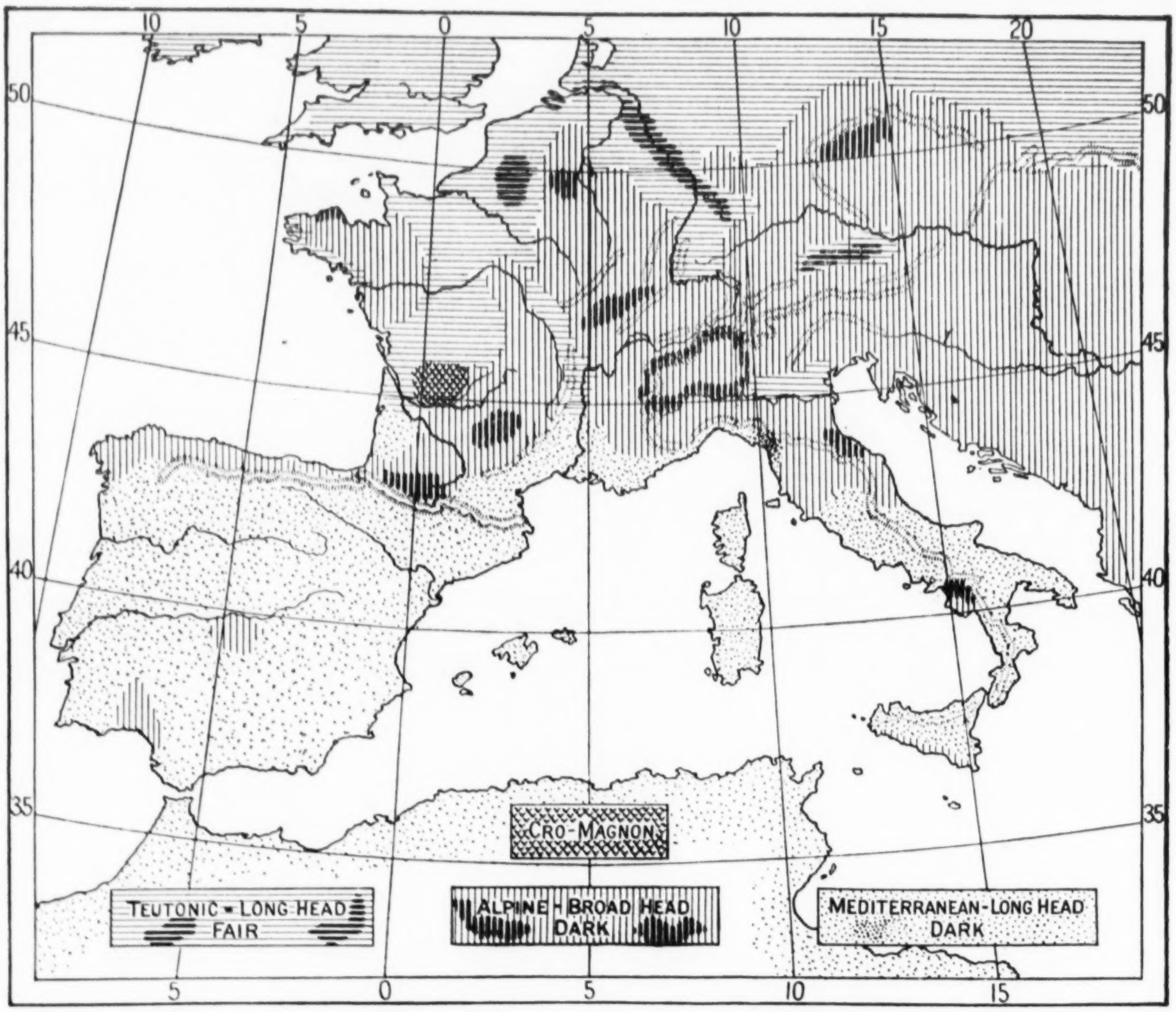
A GREAT PREHISTORIC RACE

These early residents disappeared suddenly from Europe about 25,000 B. C., when they were apparently exterminated by a new and far higher race, the famous Cro-Magnons, who were "of very modern aspect," taller than modern Europeans, and with a greater brain capacity. "The Cro-Magnon culture is found all around the basin of the Mediterranean, and this fact, together with the conspicuous absence in eastern Europe of its earliest phases . . . indicates that it entered Europe by way of North Africa. . . . There is little doubt that the Cro-Magnons originally developed in Asia and were in their highest stage of physical development at the time of their first appearance in Europe." They persisted for about 15,000 years, led the life of huntsmen, had no agriculture or domestic animals, and disappeared from view as the climate became warmer. A number of other races of inferior ability appeared toward the end of this Paleolithic or Old Stone age.

"About 7000 B. C. we enter an entirely new period in the history of man, the Neolithic or New Stone age, when the flint implements were polished and not merely chipped. Early as is this date in European culture, we are not far from the beginnings of an elaborate civilization in parts of Asia. The earliest organized states, so far as our present knowledge goes, were the Mesopotamian empires of Accad and Sumer—though they may have been preceded by the Chinese civilization, whose origin remains a mystery, nor can we trace any connection between it and western Asia." Agriculture now makes its appearance in Europe and, about 4000 B. C., a great advance in the world's civilization was made when some unknown genius discovered that an amalgam of nine parts of copper and one part of tin would make the metal we now call bronze, which was not only easily worked but particularly suitable for tools and weapons. This introduced the Bronze Age in Egypt, where the discovery was made. The people of western Asia acquired superior weapons and soon swept into and conquered Europe, into which territory small numbers of them had apparently been filtering for many centuries.

AN INVASION FROM ASIA

These invaders are nowadays known as the Alpine race. "The western



THE PRESENT RACIAL GEOGRAPHY OF EUROPE

In Central France is a small area where descendants of the great prehistoric Cro-Magnon race are supposed still to survive; but apart from this the region above shown is almost exclusively occupied by three great races, whose distribution is roughly shown by the shading, which is made particularly heavy in the places where the race is purest or most numerous. Unfortunately, the map does not show Scandinavia and the northern part of the German Empire, where the Nordic race, "The Great Race," as Mr. Grant calls it, is purest and most predominant. From H. F. Osborn, Men of the Old Stone Age (New York, 1915). (Fig. 16.)

Himalayas were probably its center of original evolution and radiation, and its Asiatic members constitute a distinct subdivision, the Armenoids.

"The Alpine race is distinguished by a round face and correspondingly round skull which in the true Armenians has a peculiar, sugarloaf shape, a character which can be easily recognized." The Alpines must not be confounded with the slit-eyed Mongols who center in Tibet and the steppes of north Asia. They are "of medium height and sturdy build, both as to skeleton and muscles. The coloration of both hair and eyes was originally very dark and still tends strongly in that direction, but many light-colored eyes, especially gray, are now found in the Alpine populations of western Europe.

"This race in its final expansion far to the northwest, ultimately reached Norway, Denmark and Holland, and planted among the dolichocephalic natives small colonies of round skulls, which still exist. When this invasion reached the extreme northwest of Europe its energy was spent, and the

invaders were soon forced back into central Europe by the Nordics. The Alpines at this time of maximum extension, about 1800 B. C., crossed into Britain, and a few reached Ireland and introduced bronze into both these islands." In Britain, however, they made little permanent mark. At the present time they form the great bulk of the population of central France; they represent the Slavs of the countries to the east—the Czechs, Slovaks, Poles, Serbs, Croats, etc. The Magyars, who now form the dominant party in Hungary, are racially distinct, being an Asiatic group allied to the Turks. Alpines are to be found in large numbers in southern Germany and northern Italy.

The early Alpines brought civilization to Europe, with the culture of the Bronze Age; and in Asia they have to their credit the first real civilizations on record—those of the Tigris and Euphrates valleys. But "in classic, medieval and modern times the Alpines have played an unimportant part in European culture. . . . There are, however, many indications in current history which point to a great development of civilization in the Slavic branches of this race."

AN INVASION FROM AFRICA

These round-skulled Alpines had pushed themselves like a wedge into central Europe. To the north of them were the Teutonic tribes, the Nordic race presently to be described; to the south was the Mediterranean race, which is called Iberian by old writers. This is "a relatively small, light boned, long skulled race, of brunet color, becoming even swarthy in certain portions of its range. Throughout Neolithic times, and possibly still earlier, it seems to have occupied, just as it does today, all the shores of the Mediterranean, including the coast of Africa from Morocco on the west to Egypt on the east. The Mediterraneans are the western members of a subspecies of man which forms a substantial part of the population of Persia, Afghanistan, Baluchistan and Hindustan, with perhaps a southward extension into Ceylon."

"This Mediterranean subspecies at the close of the Paleolithic spread from the basin of the Inland Sea northward by way of Spain throughout western Europe, including the British Isles, and, before the final expansion of the Alpines, was widely distributed up to and touching the domain of the Nordic dolichocephs. It did not cross the Alps from the south, but spread around the mountains across the Rhine into western Germany."

"It is to the Mediterranean race in the British Isles that the English, Scotch, and American owe whatever brunet characters they possess. In central Europe it underlies the Alpine race, and, in fact, wherever this race is in contact with either the Alpines or the Nordics, it appears to represent the more ancient stratum of the population."

"Today the Mediterranean race forms in Europe a substantial part of the population of the British Isles, the great bulk of the population of the Iberian peninsula [Spain and Portugal], nearly one-third of the population of France, Liguria, Italy south of the Apennines, and all the Mediterranean coasts and islands, in some of which, like Sardinia, is exists in great purity. It forms the substratum of the population of Greece and of the eastern coasts of the Balkan peninsula." In Britain the Welsh are the principal representatives of this race.

MAKERS OF CIVILIZATION

"This is the race that gave the world the great civilizations of Egypt, of Crete, of Phoenicia including Carthage, of Etruria and of Mycenean Greece. It gave us, when mixed and invigorated with Nordic elements, the most splendid of all civilizations, that of ancient Hellas, and the most enduring of political organizations, the Roman State."

"Even though the Mediterranean race has no claim to the invention of synthetic languages, and though it played a relatively small part in the development of the civilization of the Middle Ages or of modern times, never-

theless, to it belongs the chief credit of the classic civilization of Europe, in the sciences, art, poetry, literature, and philosophy, as well as the major part of the civilization of Greece and a very large share in the Empire of Rome."

"With the fall of Constantinople [1453 A. D.], the Empire of Rome passes finally from the scene of history, and the development of civilization is transferred from Mediterranean lands and the Mediterranean race to the North Sea and the Nordic race"—the "Great Race" after which Mr. Grant's book is named.

It has been shown that the Mediterranean race came from Asia, via North Africa; that the Alpine race also came from Asia, through Asia Minor and the valley of the Danube. Of the three races which make up practically all of modern Europe, only the Nordic can claim to be indigenous: although its ancestors doubtless came from Asia originally, it has developed its physical characters and its civilization in north Europe. "It is everywhere characterized by certain unique specializations, namely, blondness, wavy hair, blue eyes, fair skin, high, narrow and straight nose, which are associated with great stature, and a long skull, as well as with abundant head and body hair."

HOME OF THE ORIGINAL EUROPEANS

"For the development of so marked a type there is required a continental area isolated and protected for long ages from the intrusion of other races. The climatic conditions must have been such as to impose a rigid elimination of defectives through the agency of hard winters and the necessity of industry and foresight in providing the year's food, clothing and shelter during the short summer. Such demands on energy, if long continued, would produce a strong, virile, and self-contained race which would inevitably overwhelm in battle nations whose weaker elements had not been purged by the conditions of an equally severe environment.

"An area conforming to these requirements is offered by the forests and plains of eastern Germany, Poland and Russia. Here the race gradually evolved, and spread early into the Scandinavian peninsula, where it is now found in its greatest purity. History first shows them, very dimly, introducing the Sanskrit language to India, pouring through the passes of the Caucasus from the grasslands of southern Russia to invade Persia, and entering Greece and Italy from the north. About 1000 B. C. they crossed the Rhine into Gaul. They reached Britain about 800 B. C."

"The men of Nordic blood today form all the population of Scandinavian countries, as also a majority of the population of the British Isles, and are almost pure in type in Scotland and eastern and northern England. The Nordic realm includes all the northern third of France, with extensions into the fertile southwest; all the rich lowlands of Flanders; all Holland; the northern half of Germany, with extensions up the Rhine and down the Danube; and the north of Poland, and of Russia. Recent calculations show that there are about 90,000,000 of purely Nordic physical type in Europe, out of a total population of about 420,000,000.

NORDIC THE RULING ELEMENT

"Throughout southern Europe Nordic nobility of Teutonic type everywhere forms the old aristocratic and military classes, or what now remains of them. . . . In the Europe of today the amount of Nordic blood in each nation is a very fair measure of its strength in war and standing in civilization."

With a few trivial exceptions, then, all Europe is divided between these three distinct races—the Nordic, Alpine, and Mediterranean. Of course, it is not to be supposed that they do not overlap, or that a great amount of intermixture has not taken place. The settlement of North America was due to Nordics and, according to Mr. Grant, the early *conquistadores* of the New World represented the old Nordic element of Spain.

"Mental, spiritual and moral traits are closely associated with the physical distinctions among the different European races. . . . The Alpine race is always and everywhere a race of peasants, an agricultural and never a maritime race."

"The Nordics are, all over the world, a race of soldiers, sailors, adventurers and explorers, but above all, of rulers, organizers and aristocrats in sharp contrast to the essentially peasant character of the Alpines."

"The mental characteristics of the Mediterranean race are well known, and this race, while inferior in bodily stamina to both the Nordic and the Alpine, is probably the superior of both, certainly of the Alpines, in intellectual achievement. In the field of art its superiority to both the other European races is unquestioned."

As the Nordic has always been a race of fighting men, it is not surprising that it should have suffered severe losses, such as occurred during the Thirty Years' War in Germany, to name only one example. "All the states involved in the present world war have sent to the front their fighting Nordic element, and the loss of life now going on in Europe will fall much more heavily on the blond giant than on the little brunet."

"The wars of the last 2,000 years in Europe have been almost exclusively wars between the various nations of this race, or between rulers of Nordic blood.

"From a race point of view the present European conflict is essentially a civil war, and nearly all the officers and a large proportion of the men on both sides are members of this race. . . . It is hard to say on which side there is a preponderance of Nordic blood, as Flanders and northern France are more Teutonic than south Germany, and the backbone of the armies that England has put in the field, together with those of her colonies, are almost purely Nordic, while a large proportion of the Russian armies is of the same race."

In addition to losses in fighting, the Nordic race has suffered severe losses in recent centuries through emigration to countries where it could not thrive. Further, the author thinks it is less adapted to urban life than is the Mediterranean race, and is therefore succumbing under modern conditions to the competition of the latter. All over the world, the Great Race is passing.

THE NORDICS IN AMERICA

In America, Mr. Grant believes, the outlook for it is particularly gloomy, due to the disregard, during the last half century or more, of the elementary principles of biology.

"Race consciousness in the colonies and in the United States, down to and including the Mexican War, seems to have been very strongly developed among native Americans, and it still remains in full vigor today in the South, where the presence of a large negro population forces this question upon the daily attention of the whites.

"In New England, however, whether through the decline of Calvinism or the growth of altruism, there appeared early in the last century a wave of sentimentalism, which at that time took up the cause of the negro, and in so doing apparently destroyed, to a large extent, pride and consciousness of race in the north. The agitation over slavery was inimical to the Nordic race, because it thrust aside all national opposition to the intrusion of hordes of immigrants of inferior racial value, and preventing the fixing of a definite American type, such as was clearly appearing in the middle of the century.

"The Civil War was fought almost entirely by unalloyed native Americans."

"The prosperity that followed the war attracted hordes of newcomers who were welcomed by the native Americans to operate factories, build railroads, and fill up the waste spaces—'developing the country' it was called.

"These new immigrants were no longer exclusively of the Nordic race as were the earlier ones who came of their own impulse to improve their social conditions. The transportation

lines advertised America as a land flowing with milk and honey, and the European governments took the opportunity to unload upon careless, wealthy and hospitable America the sweepings of their jails and asylums." The result was that immigration of Nordics nearly ceased and the incoming stream was composed mainly of Alpines and Mediterraneans, and in many cases of the poorer representatives of these two races.

EUGENICS NEEDED

"As to what the future mixture will be it is evident that in large sections of the country the native American will entirely disappear. He will not intermarry with inferior races, and he cannot compete in the sweat shop and in the street trench with newcomers. Large cities from the days of Rome, Alexandria and Byzantium have always been gathering points of diverse races, but New York is becoming a *cloaca gentium* which will produce many amazing racial hybrids and some ethnic horrors that will be beyond the powers of future ethnologists to unravel." The only hope for the preservation of the Great Race, Mr. Grant thinks, is through general realization of the biological principles involved, and a thorough campaign of eugenics. He believes that democracy is not favorable to the preservation of superior strains.

Whether or not the reader wholly accepts Mr. Grant's estimate of the values of the respective races, or shares his pessimism about the future of the Great Race to which the founders of the North American colonies belonged, a study of this book is certain to result in a much clearer view of international problems, and a new conception of history which is likely to be more valuable than the conventional one which classifies people by nationality or language, instead of by race.

Colony Care for the Feebleminded

There are now in the United States several hundred thousand feebleminded persons who should be given custodial care (1) for their own protection, because they are unable to compete on even terms with people of normal intelligence, and (2) for Society's protection, in order that they may not reproduce their kind. The problem of finding ways in which they can be cared for without too great expense has been successfully met in a number of places by the establishment of colonies where they are economically housed, sexually segregated, made happy, and made to contribute largely to their own support. The colony plan seems to be the best yet devised for their care, and the Committee on Provision for the Feebleminded (702 Empire Building, Philadelphia) has issued an eighteen-page bulletin describing its operation in New Jersey, in such a way that other communities will know how to adopt it. Copies of this bulletin can be had for 5 cents each, singly, or at 3 cents each in quantities of fifty or more.

Annual Business Meeting of the A. G. A.

The annual business meeting of this association will be held, in conformity with the by-laws, in Washington on the second Thursday in January at 5 o'clock in the afternoon. Three members of the council are to be elected, those whose term of office expires being George M. Rommel, T. H. Kearney and W. C. Rucker. The regular annual meeting of the council is to be held on the third Tuesday in January, at which time officers will be elected.

HEREDITY VS. ENVIRONMENT

An Attempt to Show that the Jukes Might Have Been Reclaimed if Given a Good Environment—Evidence Alleged Has no Critical Value

A. H. ESTABROOK, *Indianapolis, Ind.*

THE Children's Aid Society of New York, in the "Emigration of Homeless Children to the Country," 1910, tells of one little foundling (page 7) who, upon investigation, was found to be descended from "Margaret, the mother of criminals," a member of the Juke family of criminals, paupers and defectives, described by Dugdale in 1874. In describing the Jukes and this case, the pamphlet says, "Had the little Margaret and her sisters been born fifty years later, their unfortunate parentage and environment would undoubtedly have brought them to the attention of some one of the organized associations to be found in New York City and throughout the State, for the rescue and care of just such neglected children. They would have been saved both from the criminal negligence of the parents, and the no less culpable indifference of the public, before their innocence had been lost and their youth perverted. Transferred to some good home among God-fearing people, amid proper environment and under judicious guidance, they would, in all probability, have developed into good true-hearted women, leaving behind them a line of descendants who in honesty and uprightness would have been a blessing, instead of a curse, to the community in which they lived and have been reckoned among the good and faithful, who are the backbone of the nation. That this is not a fancy picture, the concluding incident in connection with this family will show."

The article goes on to say, "Twenty years ago there came into the care of the Children's Aid Society a little foundling, who, upon investigation, proved to be a descendant of this same Margaret in the seventh generation. A home for the child was found in the country several miles from the nearest town, with a kind-hearted widow whose own children had grown up. A careful supervision was kept over him, and for ten years satisfactory reports were received as to his progress. Then the little fellow began to develop a spirit of unruliness, and owing to the advanced age of his foster mother it was thought advisable to place him under firmer guidance, and he was removed to a distant State and placed in a home far from town, where firm discipline was joined to great kindness. Here he remained until 1901. He had then reached his young manhood and achieved a thoroughly good reputation in the community, and he struck out for himself with a good moral foundation on which to build his subsequent career. Had he been allowed to grow up after the manner of his ancestors, who is prepared to foretell the result?"

As for the first part of the statement, no one knows whether Margaret or any of her sisters was normal mentally and so capable of benefitting by the improved environment which they should have had, or was feeble-minded and so would not have been able, under *any* environmental condition, to produce a line of descendants that would be good citizens.

SAM'S CASE PROVES NOTHING

Now the young boy, whom we shall call Sam for the sake of a name, was the illegitimate child of his mother, the *father being unknown*. It may be, then, that the boy inherited potential good traits from the unknown father. The recent investigation of the Jukes has shown that many of the intelligent, industrious men of the neighborhood had immoral relations with many of the Juke women, and this child may have

been the result of some chance meeting. The good environment furnished to Sam by the activities of the Children's Aid Society gave these traits a chance to develop. But, on the other hand, these good traits *might* have developed in the Juke environment. This has been the case with some of the other Jukes. In "The Jukes in 1915" (Carnegie Institution of Washington, 1916), page 80, case 7, is the story of a family group where the father, a great grandson of "Margaret, the mother of criminals," was mentally dull and slow at school, a farm laborer, a wanderer, and had two sisters who were harlots and one brother criminal, while another sister was chaste and reputable. This man married a woman from a family much higher mentally and socially than he, industrious and capable, and they had five children: a girl, reticent, but who holds herself well; a male, who, although slipshod, was regular in his work and did well by his family; a female, more active and forward than the first girl; a male, uneducated but a steady-going farm-hand, who is doing well; and a female, mentally and physically active. There is no evidence that this family was brought up in a new and superior locality. Their father wandered and he took his family about with him. The fine mother offered the best of environment for her children, even in the Juke territory, but she gave her children still more—an hereditary capacity for taking advantage of her training, a natural self-control sufficient to act in accordance with the *mores* she inculcated. Sam's case may have paralleled this case in that the Children's Aid Society furnished the environment which the fine mother did in the one mentioned; but the inheritance of good traits was necessary for the end result secured.

The case of Sam, then, does not show that good environment can counteract poor heredity, inasmuch as no one can tell what possibilities for good or bad traits Sam may have inherited because no one knows the traits brought to Sam by the father.

In saying the above I do not wish to discount any of the activities of the Children's Aid Society or any other well-meaning charitable organization for the bettering of social conditions, but the assumption that the environment can counteract heredity cannot be proved by any example of a production of good traits in a changed environment in any individual when the traits which that individual inherits are not known.

The writer of this article has but recently studied the Juke family and has a record of Sam. He was an illegitimate child and his paternity is not known. He was born in the poorhouse and was later placed in an orphan's home, and then given to the Children's Aid Society, when he was placed in the foster home as above mentioned. He disappeared in 1902, when he probably ran away. He was a descendant of Margaret Juke in the fifth generation.

Human "Free-Martins"

Animal breeders know that when twin calves of opposite sexes are born, the female of the pair is likely to be sterile and to have many male characteristics. Such females are called free-martins, and Lillie has recently shown (*Science*, **1916**, p. **611**) that in twin calves of opposite sex the foetal circulations are usually fused so that a constant interchange of blood takes place; the action of male hormones on the female is probably responsible for the ensuing sterility. The question naturally arises whether in human twins of opposite sex the female's reproductive system is in any way affected, and a number of correspondents of the *London Lancet* report that it is not. Sir James Simpson made an extensive study of this question and reported that "the human free-martin is fertile in the same proportion and to the same degree as other women." The contrary idea seems to be unfounded.

COEDUCATION AND MARRIAGE

Women Graduates of Western Colleges and Universities Show Widely Varying Marriage Rates, but in All Cases Studied are Higher than Those of Eastern Separate Colleges—Nature of the Problem Different in Each Institution

IT IS now well known to eugenists that only from 40 to 50% of the graduates of the great women's colleges of the United States ever marry. These women come, on the whole, from superior families, and the unfortunate results of their celibacy, from a eugenic viewpoint, are widely recognized.

Coeducation has often been suggested as likely to improve this condition, and several investigations of the marriage rate of women in coeducational institutions have been published, which seemed to substantiate this claim. Further data, however, have been needed.

It is now possible to give the marriage rate of the women graduates of the University of California, Illinois University, Ohio State University, Wisconsin University, Kansas State Agricultural College, and Oberlin College. In these great coeducational institutions, which are probably fairly representative of the universities and colleges of the West, it is found that from 50 to 67% of the women graduates marry.

A directory of graduates, published by the University of California alumni association a few months ago, lists 3,654 women. The first class graduated from the University in 1864, and in the succeeding twenty years just forty-nine women graduated, the first one of them securing her degree in 1874. After that the proportion of women in the institution steadily increased until at present they make up roughly two-fifths of the student body. One-third of the women graduates of the University of California, it is stated, are now teachers.

Taking the alumni directory, Arthur Price[1] tabulated every tenth name. This gave a random sample of the women graduates, but a rather small one for statistical purposes. He found the record as follows:

Period	*Per cent married*
1864–84	28.6
1885–94	50.0
1895–99	65.7
1900–04	60.1

The falling off in the last group, Mr. Price suggests, is perhaps due in part to the short time that has elapsed since graduation. The investigation of Wellesley data by Johnson and Stutzmann[2] showed that about one-fourth of the girls who marry at all, do so more than ten years after graduation.

Mr. Price further found that one-third of all the women who marry at all, marry University of California men. His explanation of the low marriage rate of the earlier classes is as follows:

"A generation ago, the girls who went to college were actuated by some explicit purpose, some particular zeal of learning. Now, it is a commonplace of experience for bright or studious girls, or girls who want a change of scene, to enter college and graduate. There are few California families of comfortable circumstances who have not at least one daughter a graduate or a student at the State University or Stanford."

It seems probable however, that the low percentage (28.6) is mainly due to

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[1] See San Francisco *Examiner*, Sunday, October 1, 1916. Mr. Price has kindly given further details in a letter dated October 27.

[2] JOURNAL OF HEREDITY, Vol. vi, pp. 250–3. It was found that of the classes 1879–1888, 35% had married ten years after graduation, 48% twenty years after graduation. As the authors point out, this long delay in marrying is extremely dysgenic.

the small number of cases on which it is based.

The only class which Mr. Price studied in full was the class of 1906. The figures for this are as follows:

Total number of women graduates...	189
Married.....	90
Married to U. of C. men.....	30
Unmarried.....	94
No report.....	5

Alumni records of Oberlin College, Kansas Agricultural College, Wisconsin University, Illinois University, and Ohio State University[3] have been examined by W. L. Altman of the American Genetic Association, and the marriage status of the women graduates compiled. No information was found (except in one instance) on the birth rates of these women, nor was it possible from the published data to ascertain the marriage rate of the men.

The records of Oberlin College from 1850 to 1905, inclusive, show 1,682 women graduates, of whom 1,096 (65.2%) have married. The high marriage rate here, unlike that at the University of California, is in the earlier years. If the 688 graduates, 1890–1905, are counted, 380 (55.2%) of them are found to be married.

At Ohio State University the number of women graduates, 1885–1905, is 274, of whom 148 (54%) are reported married.

From Wisconsin, 1870–1905, 1,255 women have graduated, and 650 of them are reported married, a number that is 51.8% of the total.

The total number of women graduates from Illinois University, 1880–1905, is given as 550, of whom 297 (54%) are reported married. In the years 1880–1900 inclusive 134 of the total 222 graduates married and produced 253 children: 1.14 children per graduate or 1.88 per married graduate. Presumably these figures refer to surviving children, and they are likely to be incomplete statistically, while the families of the later graduates are subject to some increase through further births.

At Kansas Agricultural College, 386 women are listed as graduating in the classes 1885–1905, and of these 261 married, or 67.6% of the whole.

RECENT TENDENCIES

The question of most interest is the tendency to marriage in recent years. The five-year period, 1900–1904, represents the latest that can be taken profitably, and some who graduated in this period will yet marry. The percentages given are therefore slightly below the final ones. Various colleges for this period show the following marriage rates:

College	*Total No. grads.*	*No. married*	*Per cent married*
Wellesley[4].....	...	...	44
Wisconsin.....	458	204	44.5
Illinois.....	288	135	46.9
Ohio State.....	114	65	57.0
Oberlin.....	234	138	58.9
California[5].....	780(?)	480(?)	60.1%
Kansas Agric.....	129	82	63.5

In all these figures, it must be remembered that only graduates are considered, and that a good many girls leave college at some time prior to graduation, for the purpose of getting married. At Wellesley Johnson and Stutzman found that the inclusion of these non-graduate girls would raise the marriage rate of the whole college by 5%. The conditions described by a young woman at the University of Wisconsin probably prevail in varying degrees at all other colleges where women are admitted.

"You asked me why half of the Wisconsin girls don't marry," she writes. "I think it's because they never could have married, educated or not educated. There are a lot of pretty girls here and there are an awfully large number of homely ones and, for that matter, homely men. A lot of the most attrac-

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[3] *Bulletin of Oberlin College, N. S.*, No. 120, April 29, 1916; *Record of the Alumni of the K. S. A. C.*, 1914; *Alumni Directory of the University of Wisconsin*, 1912; *Alumni Record of the University of Illinois*, 1913; *Alumni and Students Register, O. S. U.*, 1912. The figures are believed to be corrected very nearly to the date of publication.

[4] Johnson and Stutzmann, p. 251. They give the per cent married from the classes 1901–1904 inclusive, but not the totals. Status of fall of 1912.

[5] Price's actual figures are 78 and 48. As these represent every tenth name on the list, the totals can be approximated by multiplying by 10.

tive girls don't get to be seniors. The freshman class always has the prettiest girls."

The percentage of graduates who marry from the women's separate colleges of the East appears to vary from 40 to 50, in most instances being nearer the smaller figure.[6] None of the coeducational institutions here considered shows as low a rate as this. Direct comparison is not legitimate, because each college represents a different social and geographical environment. The marriage rate, not only of college graduates but of all other women, may be lower in the East than it is in the West.

Furthermore, the percentage of graduates who marry is only one item of a number that must be considered by eugenics. In any discussion of the relative merits of the separate colleges and coeducation, it is important to know which group of women marries at the earlier age, which gets the better mates, which has the larger number of children and which brings the greater number of children to maturity. Data on these points are not now available.

There is no reason for surprise that the marriage rate of women from even the highest college should be low, when it is remembered that a good deal of selection has taken place before women go to college, as well as during the course of the college career. Many of those who take college degrees are girls to whom marriage is unattractive, or who are through some mental or physical characteristic not likely to find husbands, and who are, therefore, put by their parents into a "career." These girls would not have married in any case; therefore their chances were not impaired by a college education. In the case of many other girls, however, it is a serious question whether a college education is not mainly responsible for their failure to marry. Reasons have been set forth in previous issues of the JOURNAL OF HEREDITY for thinking that this is more true of the separate women's colleges than of the coeducational institutions.

Hindu Ideas on Heredity

THE SACRED BOOKS OF THE HINDUS, Vol. XVI. The Positive Background of Hindu Sociology, Book I. By Prof. Benoy Kumár Sarkár, with appendices by Dr. Brajendranáth Seal. Pp. 365. Price Rs. 6. Allahabad, the Pânini office, 1914.

Prof. Sarkár's volume, dealing principally with the ethnology, mineralogy, botany and zoology of the Sanskrit literature, offers many interesting glimpses of primitive science. His attempt to show that the early Hindus possessed considerable knowledge of plant-breeding is hardly successful, although it is certain that they were familiar with such processes as grafting. In an appendix on Heredity, Dr. Seal says that the early Sanskrit scientists held a view of evolution corresponding to the *emboîtement* theory, that Charaka had put forth an hypothesis almost identical with Darwin's hypothesis of pangenesis, and that the isolation of the germ-plasm was well understood. The idea of continuity of germ-plasm was never reached, although it logically followed from the views held. It was clearly recognized that a character, to be inherited, must originate in the germ-plasm, not in the body, and the non-inheritance of acquired characters was explained by this very good hypothesis. Speculative views on evolution appear to have been shrewd, ape-like forms being designated as man's ancestors, while it was also pointed out that man's ancestors must at one time have been aquatic. The author believes that Hindu philosophers must be recognized as having long antedated the Greeks in the foundation of biological science.

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[6] For the details see Sprague, Robert J., Education and Race Suicide. JOURNAL OF HEREDITY, Vol. vi, pp. 158–162. The methods of compilation vary with each college. The marriage rate at Mount Holyoke appears to be only 41.9, at Bryn Mawr 43.9, at Vassar 49%.

INFLUENCE OF HEREDITY IN STAMMERING

FRANK A. BRYANT, M.D.
New York, N. Y.

STAMMERING or stuttering (I use the terms synonomously, for most English speaking authorities agree that stuttering is a form of stammering) is one of those traits which is difficult to classify as either wholly mental or wholly physical. At first sight it would appear to be a physical defect, but closer study shows that this view is not tenable. It is not an organic trouble, but a functional one, as is proved by its intermittent manifestations, which point also to its purely nervous or mental origin. It is ordinarily due to a morbid irregularity or interruption of the normal functions of the mind in its relation to speech.

This is not an argument against its transmissibility, however, for the child inherits his brain from his parents just as much as he does any other part of the body. The inheritance of various mental disorders is as firmly established as is any fact in biology. There is *a priori*, then, no reason to suppose that a tendency to stammer might not be inherited; to determine whether or not it actually is inherited, we must appeal to the evidence.

STUDY OF 20,000 CASES

In a practice of over thirty-five years, I have come in contact with more than 20,000 persons afflicted with stammering in its various forms. According to my observations and statistics, at least half of these 20,000 stammerers had relatives who at one period or another in their lives suffered from one form or another of nervous speech disorder.

In the early stages of the stammering of very young children, it begins spontaneously, seemingly without any external cause, upon the very first attempts to speak. While some cases do not show the affection until after the third or fourth year, I have never known an instance where it began with the early attempts at speech unless some blood relative had previously shown disordered utterance.

This early manifestation of the trouble precludes absolutely the assumption that it is a habit or the result of faulty education, example or environment, because the child on account of its extreme youth had never been brought under such influences.

My statistics show that the number of stammerers with relatives who have stammered is greater than the number of stammerers from all other causes put together. This furnishes a strong presumption of inheritance, which is converted into absolute proof by a study of the nature of some of these cases of relationship. It is a fact that grandchildren frequently stammer who have never seen the grandfather or grandmother who stammered. The speech of the nephews and nieces of an affected person is likewise impaired; and cousins who have never seen each other frequently stammer. Such crucial instances offer the best evidence possible of real inheritance.

Many cases of what might be called atavism have come under my observation. I mean cases of stammering which seem to have skipped one or more generations. The following description of what occurred in one family of my practice will illustrate the point.

> A man who lived to be 80 years of age was a stammerer from childhood. It could not be ascertained whether any of his relatives had ever been afflicted in this way. He had two sons, Robert and Henry. Robert, the elder son, showed stammering in his first attempts to talk. He grew to manhood a stammerer, married and had two or three children, neither of whom was afflicted with speech trouble.
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> One of these children, William by name, also had two children, a boy and a girl, both of whom stammered quite severely from no apparent cause from the time when they first began to speak. This was in the fourth generation from the

original stammerer. The affection had skipped the grandson, William, to appear again in the great-grandchildren. Fortunately, I, with the aid of good sensible parents, was able to take them in hand within a few weeks after it first appeared in each case, and it was soon cured. These children are now 12 to 15 years of age, and they are now and have been ever since their early treatment, absolutely free from any trace of stammering. In fact, the boy is quite a young orator.

Henry, the younger son of the original stammerer, although constantly associated with his stammering father and stammering brother Robert, never showed any signs of the disorder, but curiously enough, his son James became a bad stammerer. This boy James, whose father, Henry, was skipped, was a grandson of the original stammerer. He also was cured, but not until some years after it made its first appearance.

The individuals referred to were all native born intelligent Americans, enjoyed good health, had no stigmata, no bad habits, were not "nervous" people, and occupied stations in business and professional life rather above the average. The facts as related are authentic, for I saw all the persons mentioned; and I believe it to be a true example of the effect of heredity in causing stammering.

SUMMARY

Stammering, in most if not all cases, being due to an unusual excitability and instability of those cells of the cortex which preside over the function of speech, it follows from the general principles of heredity that when such a condition exists in a parent it is likely to be reproduced in the child.

Statistics confirm this expectation, showing a family history of stammering in a majority of cases.

The affected relative is often one whom the child has never seen. This, with the fact that stammering often appears at the first attempts to speak, precludes the idea that the defect is due solely to imitation, and proves that we are dealing with a true germinal trait. When a parent stammers, part of the children may stammer and the rest speak normally, a further proof that association and imitation will not necessarily cause stammering unless there is a inherited predisposition.

Cases of inherited stammering, if treated early, are usually curable.

Japanese Tests of Tree Seeds

In 1902, the International Association of Forest Experiment Stations arranged a coöperative research to extend over ten years. The Japanese section of this was concerned with three important forest trees: *Cryptomeria japonica*, *Pinus densiflora*, and *Pinus thunbergi*. Among the interesting conclusions published by H. Shirasawa and Koyama are the following:

1. Seeds obtained from a young seed-tree (20 to 30 years old) are large and seedlings grown from such seeds show a better growth.

2. Seedlings from the seeds produced in localities warmer than that of the nursery, will grow better than those obtained from colder districts, so that it is always advisable to bring seeds from warmer places; if there is fear of frost, care should be taken to protect well against it, since the seeds from warmer localities continue their vegetation later in the fall, so that new buds coming late may suffer from an early frost and perish in winter.

3. Forest trees, grown from seedlings originating in warmer districts than the nursery, bear many flowers and fruits in their early years; trees grown from the seeds of a climate colder than that of the nursery bear few flowers and fruits and are very slow in growth.

As to the influence of the age of the seed-tree, old trees give rise to a smaller number of fertile seeds capable of producing saplings, but which are of slower growth. This is particularly true in the case of *Cryptomeria japonica;* but in the case of *Pinus densiflora* and *P. thunbergi*, the difference is hardly recognizable.

For the reasons above stated, the best tree seeds should be taken from a young seed-tree grown in a locality similar in climate to the place where the seeds are to be sown.—Abstract from *Int. Inst. of Agric.*

WHAT GENETICS IS

"An exact determination of the laws of heredity," says William Bateson, "will probably work more change in man's outlook on the world, and in his power over nature, than any other advance in natural knowledge that can be clearly foreseen."

To gain this knowledge is the object of the science of genetics, which proceeds, in practice, largely by means of plant breeding and animal breeding, for the reason that heredity is less complicated in these organisms than in Man, and its operation can be more easily made out. The knowledge so gained finds its application in methods for the improvement of cultivated plants and domesticated animals and, most important of all, in the improvement of the human race through the science of eugenics, which was defined by its founder, Francis Galton, as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally."

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